ARCHIVES OF OPHTHALMOLOGY.

A NEW TECHNIQUE FOR THE EXPRESSION OF THE CATARACTOUS LENS IN ITS CAPSULE.

BY LT. COL. HENRY SMITH, C. I. E., I. M. S. (RET'D), NEW ELTHAM, SURREY, ENGLAND.

(With eighteen illustrations in the text.)

IT is commonly advanced by the opponents of intracapsular extraction of cataract, that those of us who practice it by its expression method, simply put pressure on the outside of the globe until we squeeze out, according to our luck, the lens, or the lens and some vitreous, and that we have no definite plan of action.

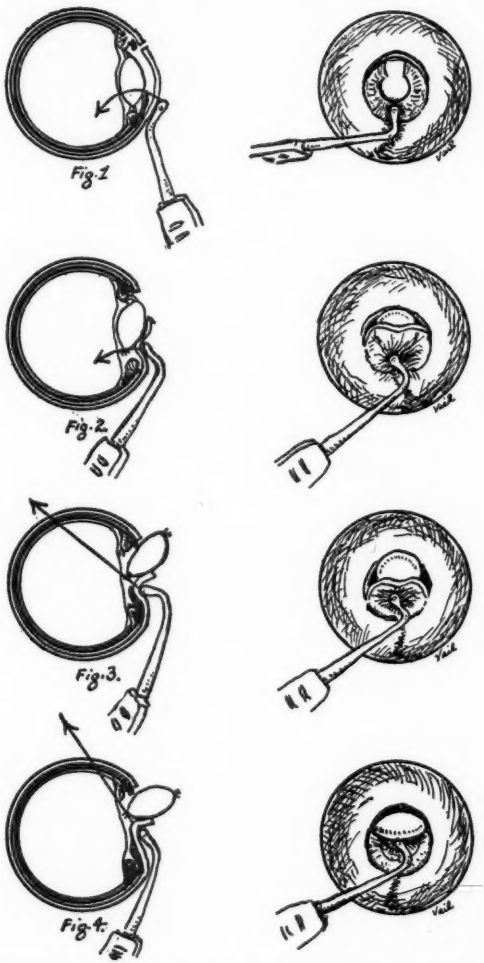
This is not so, nor can success be achieved with any of the Kalt capsule forceps, or Van Hulen-Barraquer vacuum spoons, if the surgeon using them simply attempts to pluck the lens from its moorings by main force.

Success will only be attained if the surgeon realizes that he must first dislocate the lens, and detach it from the suspensory ligament, before he can remove it from the eye. He can only do this if he makes it swing about some transverse axis, so as to concentrate the strain on the suspensory ligament at one or two points. This applies equally to the extraction and the expression methods.

In the method which I evolved first, and stuck to in the main, during my time of active service in the I. M. S., the lens is made to swing about a transverse axis, which passes through its horizontal diameter. The lens hook is placed on the flat over the lower part of the cornea, the point above and the heel

below. The point is then twisted sharply backward, by rolling the handle of the instrument between the thumb and fingers. With the hard lens this will push its lower edge back and cause its upper edge to come forward, stretching the suspensory ligament above, and below. In many cases, especially in old patients, with this simple twist, the ligament will rupture, above and below, and then the lens is maneuvered out with the gentlest pressure; the point of the squint hook being directed into the flexure of the cornea to push the lens out and fold the cornea behind it. The instrument must be held in the hand as lightly as a feather. As the lens emerges and swings around, it is rolled between the thumb and fingers to keep the direction of the pressure always at right angles to its surface.

The difficulty with this method comes when the suspensory ligament is more firmly attached to the lens. More force than is provided by the initial twist back of the point of the hook is required for dislocation. It is obtained by making pressure with the heel of the hook toward the optic nerve, keeping the point all the time twisted backward. This puts up hydrostatic pressure with the vitreous on the back of the lens, and drives its upper edge forward where the suspensory ligament consequently ruptures first. At this point lies the trick. If the surgeon has a good pair of hands he will actually feel the suspensory ligament give way, before he sees the lens emerging. If he then acts with the necessary promptness, he will relax the extra pressure he is making with the heel of the lens hook, lifting it off the cornea by rotating the handle of the instrument between thumb and fingers and will avoid squeezing out the vitreous between the back of the lens and the scleral lip of the wound. But if the surgeon is heavy-handed he will not feel the dislocation occurring, and will not relax the pressure with the necessary promptness, but will inevitably have a considerable proportion of escape of vitreous in his cases. The dexterity necessary for this job is to be obtained only by long practice and careful personal instruction from an expert. And in a certain small percentage of cases, the suspensory ligament is so strong, so elastic, that the upper border of the lens must be driven out of the wound before it will rupture. In these cases even expert hands will be unable to avoid some escape of vitreous.



THE UPRIGHT DELIVERY OF AN EASILY DISLOCATED HARD CATARACT.

Figure 1 represents the lens hook laid on the flat over the lower part of the cornea, the point above. The arrow shows the direction in which the point is moved by rolling the handle of the instrument between the thumb and fingers. The lens dislocates at once and subsequent figures show the direction of pressure changed to follow it up as it emerges. The vitreous suffers no deformity.

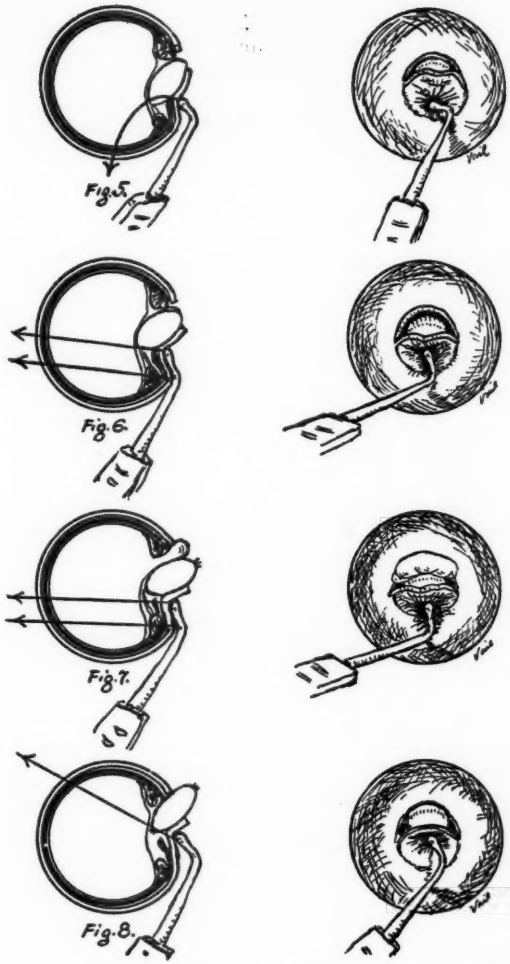
The section views are copied from drawings sent by Colonel Smith and the front views are original sketches by Dr. D. T. Vail, Sr., of Cincinnati.

The further development of the subject arose from the frequency with which the Morgagnian or soft cataract bursts its capsule, when delivered this way. I very soon found that though I could dislocate it and bring it out upper edge first as easily as the hard cataract in the way just described, I had to adopt some other method of delivery to get away from this complication.

The method I adopted is as follows: The lens hook is placed over the cornea as before, and the point twisted back by rotating the handle of the instrument between the thumb and fingers. But this rotation is continued until the point comes up against the resistance of the sclero-corneal "ring." Sufficient pressure toward the optic nerve is obtained to keep the point of the hook from slipping over this ring, while we endeavor to pull the eye toward the patient's feet. He unconsciously resists our effort and so the wound is made to gape, while the backward pressure we are making is communicated to the vitreous, and by it to the back of the lens. In this way hydrostatic pressure forces the lens forward into the gaping wound. For some reason the suspensory ligament always gives way first below, and the lower border of the lens rolls up under the point of the squint hook. The suspensory ligament remains attached above even when the lens is delivered right out of the wound, and is an effective barrier to the escape of vitreous between the lens and the scleral lip of the wound. If we maintain our downward pull on the sclero-corneal ring, after the lens has rolled well up, we will squeeze out vitreous between it and the corneal flap; but this should only occur with very clumsy hands, for at the psychological moment it is a simple matter to rotate the point of the hook upward and keep the corneal flap pressed against the posterior surface of the emerging lens. And even if the surgeon is a bit too slow in doing this, and vitreous presents, he can repair his error quite easily before harm has occurred.

This rotation of the lower edge of the lens forward about a transverse axis which passes through its upper edge, so that it and not the upper edge is delivered first, is what I have called the "tumbling" of the lens.

These two methods served me to my complete satisfaction during my years of active service in the I. M. S.; but when I

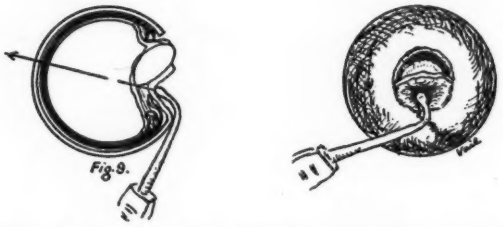


THE UPRIGHT DELIVERY OF THE MORE FIRMLY ANCHORED HARD CATARACT.

The lens refuses to dislocate on the first backward twist of the point of the lens hook.

So pressure has to be made with the heel as well as the point of the lens hook to drive the lens forward by the hydrostatic pressure of the vitreous. The suspensory ligament is shown on the point of parting from the lens in Fig. 6, while in Fig. 7 the result which follows in heavy hands is shown. The pressure with the heel of the hook toward the optic nerve has not been relaxed the moment the ligament has given way, and vitreous is pressed out along with the lens and above it; while in Fig. 8, the heel has been lifted out the right moment; the pressure relaxed and altered in direction.

visited the United States and Canada, in the summer of 1921, after my retirement, my pupils told me that in the hands of men with but small cataract clinics the first method, *i.e.*, upright delivery of the hand lens, was attended with too much escape of vitreous. This applied less to those of my pupils who had been fortunate enough to work up an extensive reputation for cataract work. But the difficulty of controlling escaped vitreous experienced by beginners was completely preventing new men from taking up intracapsular extraction.

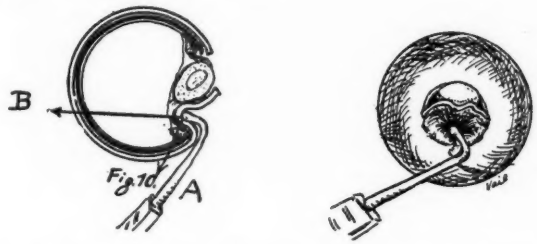


In the case of some very firmly attached suspensory ligaments the lens has to be delivered right out of the wound before they will give way and vitreous loss is almost unavoidable in the upright method of delivery.

Since then the ophthalmic profession has been in labor to produce some safe method of extracting the lens in its capsule. The line which has been explored is the use of some form of instrument with which to grasp the capsule,—the various forms of Kalt forceps, and Barraquer suction spoon are essentially the same—and extract the lens. As I have said before, success will only be obtained if the surgeon employs pressure on the lens with them to sway it round on some transverse axis and dislocate it before attempting to remove it from the eye. If they are used simply in an endeavor to pluck the lens out by main force, the only result will be to tear a piece out of the capsule.

To Dr. Arnold Knapp, of New York, belongs the credit of showing the world how to use a capsule forceps, properly. When with me in Jullunder he was greatly struck with the simplicity and safety with which the Morgagnian or soft lens can be "tumbled." He uses his forceps to grasp the capsule below and to dislocate the lens here first. If he succeeds, he

withdraws the forceps and presses straight back on the lower part of the cornea with the point of a lens hook. The hard lens "tumbles" up, and he delivers it in the same manner as a soft one. By doing this he gains two advantages. His incision does not need to be so large that it will allow both lens and instrument to escape at the same time; and he has the freedom from escape of vitreous which is provided by delivering the lens as a tumbler.

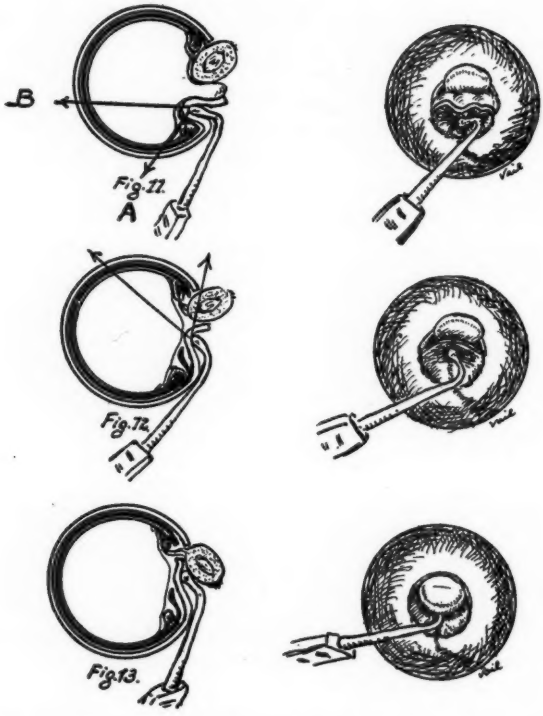


THE DELIVERY OF THE SOFT (MORGAGNIAN) CATARACT AS A "TUMBLER" LOWER EDGE FIRST

The point of the lens hook is twisted backward and downward until it gets a grip on the sclero-corneal ring. It is then used to pull the eye toward the patient's feet (arrow A), sufficient backward pressure to prevent it slipping being kept up (arrow B). The lens dislocates below at once and rolls up under the point on the lens hook, remaining attached to the suspensory ligament above.

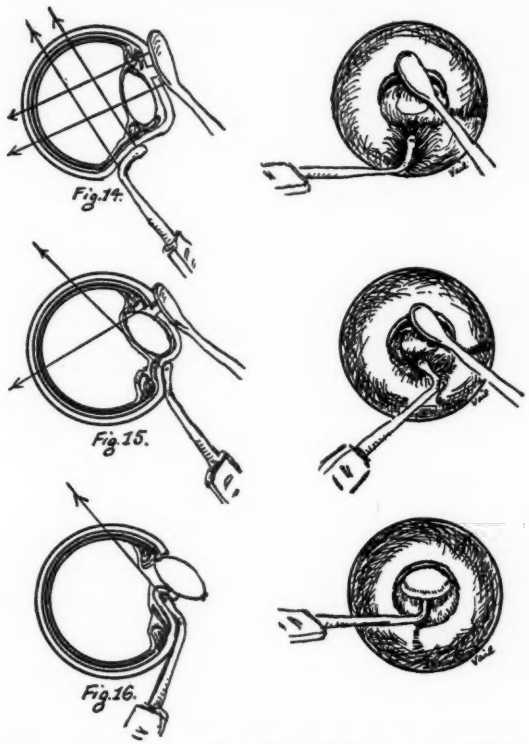
When I saw Barraquer in Barcelona, in January, 1921, he was inserting his spoon over the brow and hauling out the lens front edge foremost. But he must have given this up very shortly afterward, for there is no hint of it now in his writings. He now inserts the spoon at the angle of the wound, and makes the lens rotate to dislocate it before removing it. In his article in Fisher's *Senile Cataract*, 1923, he describes its delivery both upright and as a "tumbler." I believe that he and his disciples now practice the latter as a routine.

I myself have aways told my pupils who were attempting any of the extraction methods with an intraocular instrument, that they should assist it with the pressure of a lens hook from the outside. And I believe that some of them who have tried this have found that it facilitates matters. But I have always



In Fig. 11 the surgeon has failed to relax the downward pull against the sclero-corneal ring and the backward pressure immediately lens has rolled up past the point of the hook. Vitreous therefore presents below the lens. But it is a very simple matter for him to twist the point of the hook up, and relax the pressure, when the vitreous drops back (Fig. 12). He then completes the tucking of the cornea behind the lens, which is represented in Fig. 13, lying on the front of the cornea waiting to be detached from the suspensory ligament above.

had an aversion to the use of intraocular capsule forceps or vacuum spoons. They so often sell one, and fail in the middle of the task, by losing their grip and tearing the capsule. The expression method or the Daviel operation has then to be called in to clear up the mess under disadvantageous circumstances, when more damage has been done to the eye than in

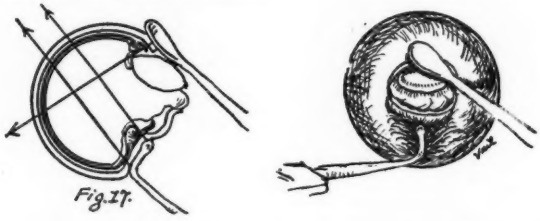


THE DELIVERY OF THE HARD CATARACT AS A TUMBLER.

In Fig. 14 the upper edge of the lens is prevented from moving forward by spoon pressure over the wound while its lower edge is driven forward by the hydrostatic pressure of the vitreous, raised with the lens hook over the sclerotic. In Fig. 15 the suspensory ligament has been torn from the lens below and the point of the lens hook has been slipped up on to the cornea behind the advancing lower edge, while in Fig. 16 the spoon has been lifted off the wound and the cornea is being tucked in behind the lens.

simple straightforward expression of the lens. And they place one at the mercy of a troublesome patient. When in addition to this we are asked to use a complicated and delicate machine such as Barraquer's pump, the situation becomes ludicrous in view of its infinite capacity for going out of order at a critical moment.

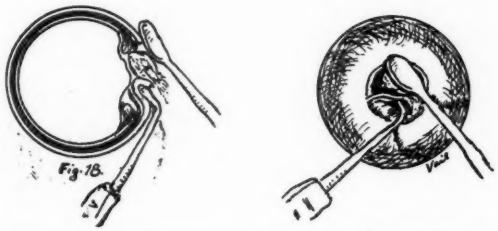
In the years that have elapsed since my retirement in 1921, from the I. M. S., I have gradually come to realize more and more, the advantages of tumbling the lens as in my method of delivering a Morgagnian or soft cataract by expression. It does not require the same high class manipulative skill, and the same constant practice as does the expression of the lens upper edge foremost if vitreous loss is to be avoided, and I have become convinced that where the capsule forceps and vacuum spoon have attained success it has been in spite of and not because of themselves, and that the secret has lain in the tumbling of the lens alone.



There has been delay in shifting the point of the lens hook on to the cornea behind the lower border of the lens and vitreous is presenting. But it is an easy matter to correct the mistake in time.

So when I revisited the Punjab with my son this winter we determined to work on some method of delivering the hard lens as a tumbler, by external pressure alone. We have been successful beyond our wildest dreams. If pressure is made upon the sclerotic over the vitreous, the latter being a fluid body, transmits it to the back of the lens and draws it straight forward. The resistance to its movement is least opposite the middle of the incision, hence its upper edge will tend to present first. To counteract this tendency we apply a smooth curved spatula, of adequate size, its convexity backward, over the middle of the incision. With it we make sufficient pressure to fix the upper edge of the lens, and prevent it coming forward. The lens hook is laid on the flat over the sclerotic below with the heel downward and the point well behind the circumference of the lens, *i.e.*, 4 to 5*mm* behind the sclero-cornea. With it we put up the hydrostatic pressure on the vitreous by pressing it on the flat toward the center of the globe. The upper edge

of the lens being prevented from coming forward by the spatula, the lower edge has no option but to do so. When it is seen to dislocate, the point of the hook is brought up on to the cornea and insinuated behind the advancing lower margin of the lens. Delivery is completed by folding the cornea behind the lens while pressure with the spoon is taken off lest the capsule burst. Finally the upper edge to which the suspensory ligament is still attached is raked off the wound.



Combined pressure as for tumbling a hard lens has been applied to one of the Morgagnian type, and its fragile capsule has been burst by pressure between the two instruments.

As in my original method of tumbling the Morgagnian or soft cataract, the vitreous is under complete control. Escape will only occur if the surgeon keeps his lens hook back on the sclerotic too long after the lower border of the lens has rolled up. And if it presents he can still prevent the damage, by making good his omission to slide up the point of the lens hook on to the cornea at the critical moment.

This method of delivery of the hard cataract is in my opinion revolutionary, for in a decent pair of hands it should eliminate loss of vitreous entirely even making it much less frequent than in the capsulotomy operation. It enables us to apply the force necessary for dislocation of the most stubborn lens, and yet keep it under absolute control. I am confident that if those who are struggling with capsule forceps or Barraquer's vacuum spoon lay these instruments aside and try this method, they will do so never to pick them up again, but will relegate them to a special shelf in a Museum, to be shared with Daviel's operation, and my original method for delivering the lens (upright), as objects of historical interest only.

But some words of warning are needed. This combined pressure with spoon and lens hook must not be applied to the big swollen soft cataract, for it will be squeezed between the two instruments and its capsule will inevitably burst. For it, my original method of tumbling still holds the field and is simplicity itself; *i.e.*, pulling the eye downward with the point of the lens hook astride the sclero-corneal ring without assistance from any other instrument. Then there is the question of the incision. It must, of course, be a full 180°, not less. In delivering the hard lens as a tumbler by combined pressure there will be less difficulty in finding the right place upon which to lay the spoon so as to prevent its upper edge coming forward, if the incision is ended in the cornea 1*mm* from the sclero-cornea so as to make a bigger ledge of sclerotic and cornea in front of the lens above. But with the big swollen soft lens this ledge tends to burst its capsule.

A CASE OF METASTATIC INTRAOCULAR MYCOSIS.

By Dr. F. H. VERHOEFF, Boston.

(From the Massachusetts Eye & Ear Infirmary.)

(With eight illustrations on Text-Plates XII. and XIII.)

IN 1924, I described a unique case of mycosis of the choroid[1] resulting from cataract extraction, with metastasis to the choroid of the other eye. Both eyes were removed, examined microscopically, and found to contain micro-organisms related to actinomycetes. In this case the patient survived the infection. Recently I have studied a fatal case of unilateral intraocular mycosis, evidently metastatic from some systemic focus, in which there was clinical evidence of involvement of the liver and endocardium. So far as I can ascertain no case of this kind has hitherto been recorded.

William T., aged 60, admitted to the Massachusetts Eye & Ear Infirmary, service of Dr. Verhoeff, June 10, 1925. Occupation is that of box car inspector. Sometimes inspects box cars that have contained cattle. On May 3, 1925, patient began to feel so tired that he stopped work. Several days later he noticed some soreness in right axilla but no pain. His right hand felt so weak he could not hold a lead pencil. His doctor found he had a fever and put him to bed. Two days later the fever had gone. Then he had swelling of flexor surfaces of phalanges with some pain.

May 30, patient, on waking, found right eye "blood-shot" and its vision blurred. The eye became more and more painful and its vision steadily worse.

[1] Verhoeff. "Mycosis of the choroid following cataract extraction, and metastatic choroiditis of the other eye, producing the clinical picture of sympathetic uveitis." *Archives of Ophthalmology*, 1924, p. 517.

EXAMINATION.

Right eye shows marked congestion, cornea hazy, iris congested. Pupil irregularly contracted, contains plastic exudate. Tension normal. Vision, light perception with faulty projection. Left eye normal, vision $\frac{20}{20}$. Left dacryocystitis. Diagnosis: Metastatic purulent endophthalmitis, right eye. The patient was referred to the Massachusetts General Hospital for a general examination. They reported, "Chronic mitral disease, compensated. Slight enlargement of liver. Malnutrition."

June 11, 1925. Enucleation of right eye.

June 16. Patient discharged.

During his stay in the hospital his daily temperature was normal and his pulse 80. After the completion of the microscopic examination of the eye and the recognition of the unusual character of the ocular infection the patient was requested to return for examination. This he did on August 25, 1925, and was referred to the Massachusetts General Hospital where he was admitted as a house patient. Here he stated that after removal of his eye his general health improved and he gained seven pounds in weight. Then he again developed a fever which his local physician was unable to explain. The patient at no time had a cough. About June 20, he noticed a small sore on his right shin. On September 8, this was excised. No cultures were taken from it and only one frozen section made of it. Microscopic examination of the section, which was stained in hematoxylin and eosin, showed chronic inflammation and a small area of necrosis. No granules were found. The patient was treated with potassium iodide in increasing doses.

Following are the chief findings at the hospital: Axillary and inguinal glands enlarged, but within normal limits. Upper teeth absent. Lower teeth decayed. Extensive pyorrhœa. On right shin there is a dark blue area, *2cm* in diameter covered by a scab—an indolent ulcer.

Heart: Chronic mitral disease, probably subacute bacterial endocarditis. Lungs, negative. Liver, slightly enlarged. Rectum, small nodule, size of pea, below prostate.

Leucocytosis: Aug. 30, 14,000: Sept. 7, 11,400: Sept. 21, 16,900.

Temperature: Morning 98°, evening 101°–102°. Highest 105°, on Sept. 2; 101° on discharge from hospital, Oct. 10.

Pulse: 100–120. Blood pressure: $\frac{130}{70}$. Urine: negative. Wassermann test negative. Widal test negative. Blood cultures, aerobic and anaerobic, negative.

X-ray examination: Persistent irregular filling defect in the first portion of the duodenum suggestive of ulcer.

ILLUSTRATING DR. F. H. VERHOEFF'S ARTICLE, "A CASE OF METASTATIC INTRAOCULAR MYCOSIS."

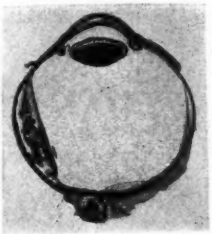


FIG. 1. Horizontal median section of eye showing subretinal exudates. Hematoxylin and eosin.

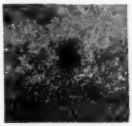


FIG. 3. Large granule in subretinal exudate. Hematoxylin and eosin. Photo × 38.

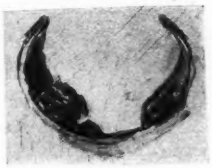


FIG. 2. Subretinal exudates higher up. Hematoxylin and eosin.

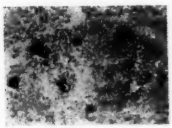


FIG. 4. Granules appearing in section as rings. Hematoxylin and eosin. Photo × 38.

FIG. 8. Endothelial phagocyte containing leptothrix filaments stained in carbol-fuchsin.

ILLUSTRATING DR. F. H. VERHOEFF'S ARTICLE, "A CASE OF METASTATIC INTRAOCULAR MYCOSIS."

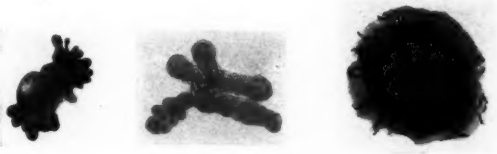


FIG. 5. FIG. 6. FIG. 7.

FIG. 5. Granule with clubs. Hematoxylin and eosin.

FIG. 6. Irregular shaped granule showing clubs with central branching stems. Hematoxylin and eosin.

FIG. 7. Small granule stained in carbol-fuchsin, showing leptothrix filaments lying in homogeneous substance.

Chest, negative. Sinuses, negative. Teeth: retained fragment left first molar. No evidence of bone destruction.

On Oct. 10, the patient refused to remain longer in the hospital and was discharged. About two weeks later he died with "symptoms of paralysis," as stated by his wife. A letter of enquiry addressed to his attending physician has remained unanswered.

PATHOLOGICAL EXAMINATION OF EYE.

Macroscopic:

(4610) Fixation in 10% Formalin 48 hours, followed by 2½% hydrochloric acid in 70% alcohol 24 hours. The globe is normal in size and shape. The anterior chamber, 1*mm* deep, is filled with coagulum. The lens is in situ. The vitreous is streaked with exudate which tends to mark out its structure, especially the canal of Cloquet. The retina is separated from the choroid by opaque gray exudate in two large ovoid areas (Figs. 1 and 2). These begin together just anterior to the equator above and diverge from each other downward, the one on the temporal side ending at the level of the disc, and the other extending somewhat further. The latter in its greatest extent reaches from the ora serrata to a point 3.5*mm* from the optic disc, and the exudate reaches a thickness of 4*mm*. The other separation is slightly less extensive and the sub-retinal exudate somewhat less massive.

Microscopic:

The sub-retinal exudate is found to consist of serum infiltrated with cells. In many sections the cellular exudate is so massive that only small lakes of serum are visible, but in some the serum predominates. No fibrin is present in this exudate. Most of the cells are so necrotic that it is usually difficult to identify them, but they seem to consist chiefly of pus cells. There are, however, many endothelial phagocytes. These are present throughout the exudates but are most easily recognizable near the choroid where they are seen filled with broken down nuclei. Many cells from the pigment epithelium as well as free pigment granules are scattered through the exudate. Within the exudate there are numerous bodies resembling granules of actinomycosis, as described below. Around the bodies the cells of the exudate have become concentrated, thus forming small tubercle-like structures with the bodies in their centers. The cells forming the tubercles are so necrotic that it is impossible to identify them with certainty. Their nuclei are pycnotic, fragmented, or absent, and their cytoplasms

indistinct, but the fact that they are mononuclear makes it almost certain that they are chiefly endothelial leucocytes.

The retina over the exudates is everywhere intact but is markedly altered. It is intensely congested and greatly infiltrated with pus cells which in places have accumulated in the form of small abscesses beneath the hyaloid membrane. Many of the retinal vessels are thrombosed and around them the retinal tissue is hemorrhagic and necrotic. The retina is not here conspicuously edematous. Away from the exudates, the retina still shows marked infiltration with pus cells, hemorrhages, and, in addition, considerable œdema. Over the macula the hyaloid membrane is elevated about 1*mm* by a sero-fibrinous exudate.

Behind the exudates the choroid is densely infiltrated with pus cells which have destroyed its structure. In places there are abscesses of considerable size, some of them being 3*mm* in diameter and 5*mm* in thickness. In some sections the membrane of Bruch and pigment epithelium are intact over the abscesses; in others these structures have been destroyed and the abscess opens into the sub-retinal exudate. There are numerous hemorrhages, especially behind the abscesses, which distend the sub-choroidal space. Only a few endothelial leucocytes can be recognized within the abscesses, and the pus cells show relatively slight necrosis as compared with the sub-retinal exudate. Around the abscesses there is beginning formation of granulation tissue. Away from the sub-retinal exudates, the infiltration of the choroid rapidly diminishes, takes on a perivascular lymphocytic character, and finally almost disappears. The sclera, behind the sub-retinal exudates, shows moderate infiltration with pus cells, while the episcleral tissue here is œdematous and shows interstitial hemorrhages and marked proliferation of fibroblasts and capillaries.

The optic disc is not swollen, but has given off a cellular exudate consisting chiefly of pus cells. From its surface there is a proliferation of fibroblasts, and its surface vessels show marked proliferation. The nerve stem is relatively normal.

The cornea shows proliferation of the corneal corpuscles and slight infiltration with pus cells. The "endothelium" is intact and there are no precipitates upon it.

The aqueous is replaced by serum which along the iris is rich in fibrin and contains many pus cells. The iris is greatly congested, and shows a few hemorrhages, but is only moderately infiltrated with pus cells. There is marked exudation of pus cells from its posterior surface and, near the pupil, also from its anterior surface. In the region of the sphincter there is marked capillary proliferation. The

pupil is filled with fibrin and pus cells. The ciliary body is practically free from infiltration, but the ciliary processes and *pars plana* are giving rise to abundant exudation of pus cells. In places they are also giving off endothelial phagocytes. From some of the ciliary processes there is beginning formation of cyclitic membrane. The lens is normal. On its capsule there are patches of pigment epithelium lett by posterior synechiæ.

The vitreous is considerably infiltrated with pus cells which are most abundant in the vicinity of the sub-retinal exudates and the ciliary body. It also contains a slight amount of serum and fibrin. The pus cells tend to collect within small foci of fibrin where they undergo necrosis. A few such foci are on the posterior surface of the lens. The cells in the vitreous, however, are far less abundant and show very much less necrosis than those of the sub-retinal exudates.

The Micro-organisms:

In sections stained in hematoxylin and eosin, numerous bodies, similar to, yet differing from those of actinomycosis, are seen within the sub-retinal exudates. They are not present in the choroid, retina, or vitreous. They tend to occur in groups, and as many as one hundred may be found in one section of one of the exudates. Some are almost perfectly round (Fig. 3), others elongated or irregular in shape. The largest measures .01*mm* in diameter, the smallest is about the size of a large endothelial leucocyte.

A typical body stains in its central portion more or less intensely in hematoxylin and shows a narrow peripheral border which stains in eosin. Under oil immersion the hematoxylin stained central portion shows an indistinct finely granular and reticulated structure.

The smallest bodies usually stain in eosin only, but some of the largest stain only slightly in hematoxylin. Some of the bodies have apparently undergone degeneration in their centers, so that the appearance of rings is produced (Fig. 4). Large round bodies surrounded by numerous typical clubs such as often occur in actinomycosis are not seen, but many of the bodies show large clubs each either staining diffusely (Fig. 5) or containing a central core stained in hematoxylin. In some of the irregular shaped bodies the basophilic substance in the center has taken on the appearance of a more or less definite stem with lateral branches which extend into eosinophilic clubs (Fig. 6). On close examination some of the bodies show very small eosinophilic clubs, some of which contain central filaments stained in hematoxylin.

Careful study of the bodies in various stages of formation seems to show that the earliest recognizable stage is a single endothelial phagocyte with a pycnotic nucleus. This loses its nucleus and becomes indistinctly granular and eosinophilic. Other endothelial phagocytes then fuse with it and undergo the same change. No doubt there is further increase in size of the bodies due to proliferation of the microörganisms. The basophilic substance is found in small as well as in large bodies and therefore probably is dependent upon the age rather than the size of the bodies.

In sections stained for two hours in carbol-fuchsin, quickly differentiated in 95% alcohol, and cleared in oil of origanum, the bodies can be seen to be densely packed with filaments. In fact, they seem to consist of filaments lying in a barely visible homogeneous substance (Fig. 7). On the filaments are deeply stained dots at frequent intervals. In the central portion of the bodies the filaments are so abundant that the individual filaments can be recognized with difficulty. At the peripheries, however, they are more discrete and are readily seen. Here they tend to have a radial arrangement, and the homogeneous substance in which they lie is more apparent. In sections differentiated too long in 95% alcohol, however, the latter substance is entirely invisible. The filaments are about .3 to .5μ in thickness and some of them are at least 30μ in length. They curve irregularly, none is perfectly straight. Often one of them extends out from the periphery of the body in the form of a loop. No branching can be recognized. In the central portions of the bodies the filaments seem to tend to fuse together so that when this process is well advanced the central portions take on an indistinctly granular appearance and assume the form of large indistinct balls or irregular figures. It is no doubt this process that produces the basophilic substance seen after hematoxylin staining. The same process also takes place in the clubs and accounts for the appearance of the indefinite branching structures sometimes brought out in the latter by hematoxylin staining (Fig. 6). Filaments can often be seen in individual endothelial phagocytes (Fig. 8) but are seldom if ever found free in the exudate.

In sections stained for two hours in carbol-fuchsin and then differentiated quickly in 95% alcohol followed by acid alcohol, the bodies stain faintly but the filaments cannot be recognized. In other words, the organism is not acid fast. The filaments also do not stain by Gram's method. Phosphotungstic acid hematoxylin stains some of the bodies deeply, but diffusely, and does not bring out the filaments. In Van Gieson's stain the bodies stain deeply in

acid fuchsin, but show no filaments. In carbol-thionin the filaments stain feebly.

Since in this case the ocular infection was confined to the interior of the eye, obviously it was metastatic in origin. The persistent fever, enlarged liver, and endocarditis, showed conclusively that other foci existed in the body, but the portal of entry of the organisms, and the site of the primary focus cannot be surmised.

Within the eye the microörganisms evidently lodged first in the choroid because the latter showed abscesses which opened into the sub-retinal space. The fact that the retina was much less infiltrated than the choroid and nowhere showed complete disintegration would seem to rule out the retina as the site of the metastases. Moreover, if the microorganisms had lodged first in the retina the subsequent exudation would no doubt have taken place chiefly into the vitreous, and not into the sub-retinal space. It is noteworthy that the microörganisms could be found only in the subretinal exudate.

The microörganisms were no doubt closely related to actinomycetes, since they produced abscesses and consisted of filaments which formed granules with peripheral clubs. The granules were not typical of actinomycosis, however, and the filaments comprising them differed essentially from actinomycosis in being more delicate, gram negative, and unbranched. The organisms were, therefore, so far as could be determined, leptotriches, although it is possible that if cultivated on artificial media they might have assumed branching forms. While not acid fast, nevertheless, like the tubercle bacillus, they stained very slowly in carbol-fuchsin, and were relatively alcohol fast. Occurring as they did within the granules and exudate they could easily be seen, but if such filaments should occur isolated within the tissues, it would be impossible to recognize them owing to the intense general staining of the tissues by the carbol-fuchsin.

The question presents itself as to whether or not the microorganisms in this case were of the same kind as those in my previous case. In the latter, only granules with clubs were found in each eye, no filaments being demonstrated either

free or in the granules. At the time of their removal both eyes had been affected for about a year, so it is possible that the organisms were dead or had lost their filamentous character. In the present case the eye had been affected only eleven days and most of the granules differed in appearance from those of my former case, yet many were so similar as to make it seem probable that in time they would have become indistinguishable from them. In my former case, surrounding the abscesses there was an abundance of granulation tissue containing numerous foci of epithelioid cells. In the present case, owing, no doubt, to insufficient time for their formation there were no such foci. It is possible that such foci represent, in part at least, a reaction against products of necrosis, such as lipoids, and fatty acid crystals. We may conclude, therefore, that the microörganisms in the two cases were either identical or closely related.

At the present time so great confusion exists in regard to the classification of the streptotriches and related organisms that it is almost useless, except possibly in cases of typical actinomycosis bovis, to attempt to assign to a particular group the organisms found in any single case. The difficulty seems to lie in the fact, as pointed out by Claypole,[1] that under different conditions the same organisms may assume different characteristics not only as regards morphology but also as regards staining reactions. In fact, there seems to be no sharp distinction between these organisms and the bacteria. Some of them resemble the tubercle bacillus in being acid fast, and their dotted appearance calls to mind the diphtheria bacillus. The formation of granules with clubs is not confined to any special group, for while such granules are generally produced by streptotriches, they may be produced by streptobacilli as in a disease of cattle described from South America by Lignieres and Spitz,[2] or by leptotriches as in my present case. It may safely be said, however, that in neither of my cases did the microörganisms belong to the variety known as actinomyces bovis.

[1] Edith J. Claypole. "Human Streptotriches and its differentiation from tuberculosis." *Archives of Internal Medicine*, 1914, Vol. XIV, p. 104.

[2] J. Lignieres and J. Spitz. "Actinobacillose." *Revista de la Sociedad Medica*, Argentina, 1902.

The formation of granules within the tissues seems to me to be analogous to the formation of capsules by bacteria. The clubs appear to consist of a capsule-like substance formed around filaments projecting from the granule, while the body of the granule itself seems to consist of masses of organisms fused together by a similar substance. In producing this substance the filaments undergo peculiar changes and finally disappear. The fact that granules are not formed in ordinary culture media may be analogous to the fact that pneumococci may produce well marked capsules within the tissues but fail to do so on ordinary culture media.

While no other cases of metastatic mycosis of the choroid seem to have been recorded, Müller[1] has reported a case of generalized actinomycosis of the internal organs in which a small nodule was found in the retina of one eye. No organisms were demonstrated in the retinal lesion. In a case reported by Fuchs[1] as one of intraocular actinomycosis, the organism evidently entered the eye during a cataract operation as in the first eye of my previous case. Fuchs based the diagnosis of actinomycosis on the presence of granules with clubs, but since no staining other than hematoxylin and eosin was employed this diagnosis is certainly open to question. As a matter of fact, the granules resembled those in my previous case more closely than those of actinomycosis. No systemic involvement was noted in Fuchs' case, and the subsequent history was not given.

Although my two cases seem to be the only certain cases of metastatic intraocular mycosis yet reported, it is possible that similiar eye conditions have been mistaken for ordinary metastatic endophthalmitis and not investigated with sufficient care. Nevertheless, it is certain that such ocular involvement is exceedingly rare. This does not necessarily mean that systemic infection with the type of organisms concerned in these cases is uncommon, because it is rare even for the frequent streptococcus and staphylococcus infections to produce intraocular metastases. Moreover, in no case of typi-

[1] L. Müller. "Ueber Veränderung im Augenhintergrunde bei Miliarer Aktinomykose." *Klin. Monatsbl. f. Augenheilk.*, 1903, 41, 1, p. 236.

[1] E. Fuchs. "Ein Fall intraokulare Aktinomykose." *Arch. f. Ophth.*, p. 14, 20, 991, 111.

cal actinomycosis have intraocular metastases been definitely demonstrated. It is possible, therefore, that systemic infection with the organisms in question may be relatively common and pass unrecognized because no lesions accessible for bacteriological examination are ordinarily produced. In the present case if the eye had not by chance become involved, the nature of the infection would have entirely escaped recognition and the case regarded as one of chronic endocarditis of bacterial origin. If the disease is a common one, it is certainly seldom fatal as otherwise it would be generally recognized.

SUMMARY.

A case is described of metastatic intraocular infection with organisms which formed granules and clubs resembling those of actinomycosis. The organisms differed from actinomycetes in that the filaments which composed the granules were more delicate, unbranched, and gram negative. They were also non-acid fast. The eye was removed and the patient later found to have fever, an enlarged liver, and evidences of endocarditis, which in spite of treatment with potassium iodide persisted until his death, about five months after the onset of the first symptoms. It is suggested that such cases, but of a milder type and without ocular involvement, may not infrequently occur, and escape recognition.

A CASE OF B. TULARENSE (SQUIRREL PLAGUE) CONJUNCTIVITIS.

By Dr. DERRICK T. VAIL, Jr., Cincinnati, Ohio.

(With two illustrations in the text and four on Text-Plate XIV.)

SINCE the publication of the first description of B. tularense conjunctivitis in 1914 by Vail, Sr.,[1] there have appeared several similar case reports which will be summarized in this article. Particular reference will be paid to the local condition. Francis[1] has brought the general knowledge of this disease up to date and his article will always remain a classic. He says "Among the few diseases of man that have been discovered in the last fifteen years is tularemia. It is the only disease of man that has been elucidated from beginning to end by American investigators alone." His article will bear careful attention by ophthalmologists particularly because this disease is probably more common than realized.

First Case Report. Vail Sr.'s[2] case showed the following features.

Male, 28, meat cutter in restaurant, onset Nov. 21, 1913. Seen three days later. O.S. affected. Redness, swelling and intense chemosis of upper and lower lids. Muco-watery secretion. Pre-auricular gland swollen and tender. Cornea clear, vision normal. Conjunctival examination revealed about ten discrete, round, yellow, necrotic ulcers, apparently punched out and filled with yellow necrotic plugs. Vary in size from 6.0*mm* to 1.0*mm*. Rest of conjunctiva deep red, swollen and boggy. Smears and cultures on ordinary media showed a mixed infection.

Diagnosis of Parinaud's disease tentatively made, but

[1] *Ophth. Rec.*, 23: p. 87, 1914.
[2] *J. A. M. A.*, 84: 1243, 1925.

withdrawn later on account of the ulcers. Nov. 28, 1913, a pustular eruption was noted on the left temple and malar region and the anterior cervical and pre-auricular glands enlarged and tender. Glanders was suspected. General reaction moderately severe with temperature running the usual septic course. Dec. 1, 1913, acute dacryocystitis. Patient discharged improved Dec. 11, 1913, but glands were enlarged and tender, and temperature still elevated in the evening. Not heard of since. Treated with mild antiseptic washes and Y. O. salve.

Drs. Wherry and Lamb[1] performed the laboratory work and isolated a pure culture of B. tularense which, dropped into the healthy eye of a guinea pig, caused the same conjunctivitis and adenitis as seen in the human case.

Second Case Report. Sattler, R.[2] described the second case also proved by Drs. Wherry and Lamb to be due to the Bacillus tularense. This was in a female, age 43, from Indiana. Date of entrance not noted but about the first week of October, 1914. Seen twenty-four hours after onset. O.S. affected. Tense œdema of upper lid and pre-auricular swelling; rapidly extending to left side of lower jaw. Bulbar conjunctiva chemotic but cornea clear. Several points of infiltration yellowish in color and each about the size of a split pea were seen on upper and lower palpebral conjunctiva. Watery straw-colored discharge, general febrile reaction with temperature 104° F. O. D. was unaffected and hermetically sealed to prevent infection. Left preauricular adenitis.

The disease lasted seven weeks and was characterized by a fluctuating temperature, and waxing and waning of lymph gland enlargement. Five weeks after onset the ocular (bulbar) conjunctiva showed a small caseated nodule about the size of a barley grain. This was excised. Immediately there occurred an acute exacerbation of the local and general condition which slowly subsided and was gone in two weeks. The lymph node which was removed did not cause the disease when injected into a guinea pig; and a histological examination of this node showed a granuloma but no giant cells.

Third Case Report. Lamb, F. W.[3] described the next case.

Young colored woman from Ohio. O.S. affected. Seen three days after onset. Nov. 11, 1916, dressed a rabbit.

[1] *Chicago Jour. Inf. Dis.*, Sept., 1914.
[2] *Arch. of Ophth.*, 44: 265, 1915.
[3] *Ophth. Record*, 26: 221, 1917.

ILLUSTRATING DR. DERRICK T. VAIL, JR.'S, ARTICLE ON, "A CASE OF B. TULARENSE (SQUIRREL PLAGUE) CONJUNCTIVITIS."

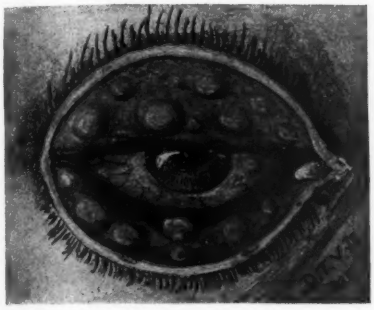


FIG. 1. O. D. Two days after admisson.

FIG. 2. O. D. Two days after admission showing the limbal nodule.

FIG. 3. Photo taken a day after admission showing swelling of O. D. and right pre-auricular and submaxillary adenitis.

FIG. 6. Photo taken forty-one days after onset. Showing right sided adenitis still present.

Two days later had a chill followed by headache and general malaise. C.C. Pain and swelling of left eyelid, accompanied by some discharge. Conjunctiva upper and lower lid showed seven small yellowish ulcers. Pre-auricular adenitis. O.S. treated with cold applications and flushing the conjunctival sac at frequent intervals with boric acid solution.

Nov. 24 she received one-half minim of vaccine, prepared by Drs. Wherry and Ben Lamb, who performed the laboratory work and proved that the disease was due to B. tularense. The vaccine was prepared by suspending the growth from a forty-eight hour pure culture on egg yolk (without scraping off any of the egg yolk) in sterile 0.85% salt solution. This was heated to 55° C for forty-five minutes, cooled and preserved with 0.5% phenol. One-half minim of the vaccine inoculated subcutaneously into the patient's arm produced over night a marked œdematous swelling about 3×4 inches and this was covered by vesicular blebs containing clear serum. Temp. rose 1.0° F. A similar reaction was produced by each successive inoculation. (I go into details relative to this vaccine because it was the first use of it on record and also because Dr. Wherry says "This simulates the mallein test for glanders and suggests the use of such a vaccine in the diagnosis of obscure cases." This has a bearing on my own case report.)

Nov. 29 she received one minim of the vaccine subcutaneously, followed by a local and general reaction.

Dec. 4, another minim, followed by a reaction next day.

Dec. 6, the swelling had nearly all disappeared from the lids and ulcers were much smaller. The pre-auricular gland was still swollen and tender.

Dec. 10, another minim, followed by a reaction the next day.

Dec. 26, the pre-auricular gland was greatly enlarged and fluctuating. Incised and material inoculated into a guinea pig without affect.

Jan. 1, 1917, the eye was entirely healed.

Fourth Case Report. Martin[1] described a case of infection in the eye (which one not stated) following the skinning of a jack rabbit by the patient on May 14, 1925. Twenty-four hours later patient had chilly sensations and general malaise. Second day temperature 103.4° and there were general body pains, severe headache, vomiting and sweating. He discovered at this time that there was an infection of eyelid. Seen one week later and a large ulcer

[1] *Southwest Med.*, Vol. 9: 232, 1925.

noticed on the conjunctiva lower lid, several on upper. Small abscess formed at inner canthus and was opened. Pre-auricular, anterior cervical and submaxillary lymph adenitis very marked. Five days after infection started serum agglutination test for B. tularense was negative. (Blood taken Jan. 3 six months later was positive in a dilution of 1:320.) Guinea pig inoculated with material obtained from abscess died seven days later. The spleen and liver were studded with miliary abscesses. Second guinea pig test also positive.

Treatment not described. Temperature of the typhoid type. Duration of the disease not given.

Fifth Case Report. Pfunder[1] described a case in which the diagnosis was made by the serum agglutination test described by Francis, one month after onset of the disease. A farmer age 63, in Montana removed some wood ticks from his horses April 6, 1925. While so doing a foreign body flew into the left eye. Two days later noticed a small papule on conjunctiva lower lid O.S. and marked pre-auricular swelling. A few days later the left eyelids were intensely swollen and œdematous. The bulbar conjunctiva was so œdematous that the cornea could scarcely be seen. On lower lid conjunctiva two small ulcers, *2mm* in diameter, were noted. Temperature 101° F. April 14 cornea was steamy in appearance. The patient was hospitalized and continuous hot applications were applied to eyelids. Pre-auricular gland continued to enlarge to the size of a hen's egg. April 24 eye was improved and patient went home against advice.

The next day, having read Francis' article which appeared April 25, Pfunder called on the patient at his home to obtain a specimen of blood for the agglutination test. The patient's blood specimen was sent to the Public Health Laboratory, Washington, and found to be positive for tularemia in a dilution of 320.

May 18 there was still considerable chemosis of eye, and the pre-auricular lymph gland was larger than before and giving signs of softening in three areas. The patient's temperature at that time was 99.6° F.

During my father's absence on a fall vacation the following case was referred by Dr. C. T. Coleman, Frankfort, Ky.

The patient, Mrs. P. T., age 27, white, resident of Kentucky, a housewife, came on November 25, 1925, complain-

[1] *A. M. A. J.*, 85: 1061, 1925.

ing of pain, swelling and slight discharge of right eye of fifteen days duration.

P. I. November 8, 1925, she had dressed two rabbits shot by her husband. During this procedure she cut her left thumb. November 10th, two days later, her right eyelids began to itch intensely, and her injured thumb became red, swollen, and painful. The left axilla was very tender and the arm could not be elevated without pain. There was a lump there the size of a hen's egg. The next morning the eyelids of the right eye were swollen and inflamed and there was a slight amount of mucoid discharge present. At the same time the pre-auricular and submaxillary glands became extremely swollen and tender. Since then her condition has remained unimproved.

P. H. Has had *stenosis of the lacrimal duct* of right side since early childhood, and has always been bothered with epiphora. General health was always excellent.

F. H. and M. H. Unessential.

P. E. The right upper and lower eyelids were markedly swollen and œdematous. The pre-auricular and submaxillary lymph glands enlarged and tender. The asymmetry to her face can be seen in the photograph (Fig. 3) taken the day after admission to hospital. The upper lid could not be everted due to the swelling. On everting the lower lid there were seen two oval, flat, yellowish-white ulcers, each about *4mm* in greatest diameter, on the margin of the lid. In the tarsal conjunctiva were seen five or six yellowish-white indurated necrotic papules on a grayish base. At the top of each papule was a small yellowish ulcer. On the upper lid margin there were two small flat ulcers. Pulling the lid forward and peering beneath with a good light, several papules, similar to those described, could be seen. These papules varied in size from a pinhead to *½cm.* The bulbar conjunctiva was brawny and œdematous especially nasally and below the cornea. At the limbus and encroaching on the cornea for *2mm* at twelve o'clock, was seen a flat, indurated, papular lesion *½cm* in diameter. Two similar nodes, much smaller in size, were seen on the bulbar conjunctiva as in the drawing (Fig. 2). This was grayish yellow in appearance but not ulcerated. The conjunctiva upon which this papule rested was intensely congested in the immediate neighborhood. There was a very slight muco-purulent discharge.

The cornea was perfectly clear (Slit-lamp note).

Iris and pupil normal.

Media clear.

Optic disk normal.

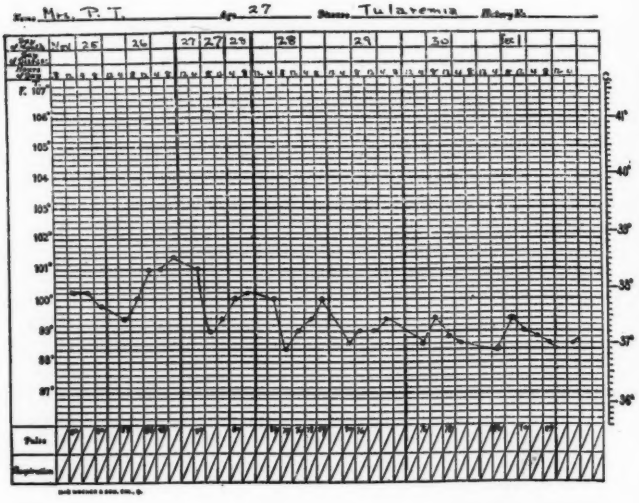
Right vision $\frac{10}{10}-$ with +0.37 cyl. ax. 60.

Left eye perfectly normal, vision $\frac{20}{20}$.

The left thumb showed a small linear wound at the metacarpal-phalangeal joint on its outer side. The entire thumb was inflamed and slightly swollen. The wound discharged a small amount of thin yellowish pus. In the left axilla a very large and tender gland could be palpated.

Pulse 80, T = 100.4° F., R = 20 on admission. The temperature curve can be seen in the chart (Fig. 4–5) and is distinctly septic in type, very similar to Lamb's case.

Fig. 4



White blood count 14,200. Polymorphonuclears 80%. Large lymphocytes 12%. Small lymphocytes 5% and Eosinophiles 3%. A remarkably large number of blood platelets seen on smear. Urine analysis negative.

Dr. D. A. Tucker (internist) reported as follows:

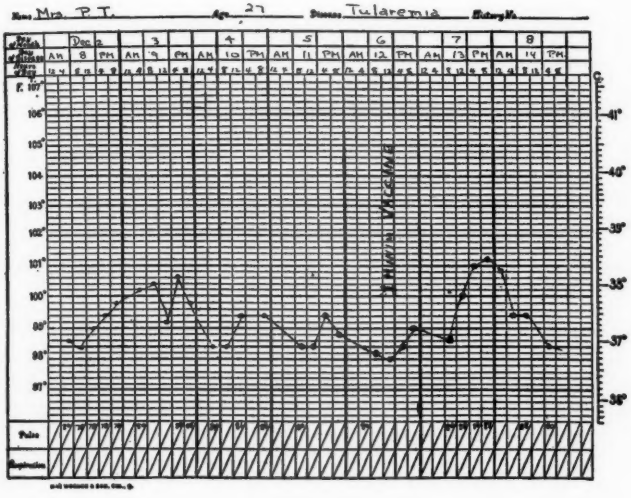
"Examination of the abdomen shows no rigidity or marked tenderness. Old scar of right rectus incision, is fairly firm except at upper end. The spleen is barely palpable and not tender. The cœcum is distended with gas and some fecal masses which move on pressure and massage. Pulsation of abdominal aorta is rather marked. The lungs are clear. The heart not enlarged, apex in 5th interspace inside nipple line. Tones are fairly good. The 2nd sound

is accentuated in all areas. Reflexes normal, no neck rigidity.

"The slight enlargement of the spleen is probably due to the toxic result of the infection. I do not believe there is any metastatic abscess however."

The ocular diagnosis was B. tularense conjunctivitis (squirrel plague).

Fig 5



TREATMENT AND PROGRESS OF THE CASE.

The patient was put to bed and hot fomentations consisting of magnesium sulphate ℥ *ss*, sodium chloride ℥*i* to hot water ℥ *viii*, applied to the right eye for fifteen minutes every hour. A drop of mercurochrome 2% was instilled every two hours in the right eye and three times a day in the left. Sodium salicylate grs. x t.i.d.; and a mild purge was ordered. An ice-collar ordered for the neck. The general treatment was reinforced by forcing fluids and general care.

November 26 (next day). Guinea pig #1 inoculated intraperitoneally with a saline emulsion of scrapings from conjunctival sac right eye. Smears from the scraping of conjunctival sac showed xerosis bacilli and a few pneu-

mococci. Cultures on ordinary media proved negative except for B. xerosis.

November 27 (2nd day). Dr. Wherry took wiping of conjunctival sac and injected it intraperitoneally in guinea pig.

Patient's right eye much improved. Swelling less, nodules decreasing in size. Can evert the upper eyelid for the first time since admission. The thumb has improved and has a small amount of discharge from the wound. The patient has kept it in a hot chlorinated soak every hour for ten minutes.

November 28 (3rd day). Eye whitening. Glandular condition unchanged. The nodule at limbus much less in evidence. An attempt was made to cut out one of the lid abscesses for microscopical study but on incision the nodule collapsed and nothing but a small amount of yellowish pus was obtained. From this a culture tube containing egg yolk was inoculated.

November 29 (4th day). Culture shows nothing beyond a few colonies of large gram negative bacilli. An emulsion made from these colonies and injected into guinea pig #2 did not cause the pig's death up to thirty days after inoculation.

Liquor aluminum acetate (Burrow's solution) dressings applied to left thumb continuously.

November 30 (5th day). Bulbar conjunctiva very white. Upper lid swollen and inflamed at outer canthus only, resembling an acute chalazion. Thumb greatly improved and free of pain.

December 1 (6th day). Guinea pig #1 died last night, six days after inoculation. Autopsy shows swollen hemorrhagic lymph glands and a greatly enlarged liver and spleen. The necrotic points described by Wherry, Lamb and Francis were not visible however. They were present but extremely minute. (See infra Dr. Wherry's report.)

December 4 (9th day). Thumb healed. Axillary gland unchanged in size although not as tender. The right eyelids were normal except for the chalazion and a slight thickening of the tarsal conjunctiva, upper and lower.

December 5 (10th day). Chalazion incised and small amount pus evacuated.

December 6 (11th day). 1 minim of vaccine injected subcutaneously in right forearm.

December 7 (12th day). Right forearm at site of injection very tender. There is a circular area of brawny infiltration 8*cm* in diameter. Temperature 101.2° F. at 8:00 P.M.

Scrapings from lower right conjunctival sac injected into guinea pig #3 proved negative.

December 8 (13th day). Patient discharged, two weeks after admission, four weeks after onset of the disease. The right eyelid nearly normal. Bulbar conjunctiva white and the little nodules have completely disappeared. The pre-auricular and sub-maxillary gland still enormous but not tender. Thumb entirely healed. Right forearm slightly better. Temperature on discharge 99.8° F.

Laboratory report of Dr. O. Berghausen (hematologist) December 8th as follows:

Blood:—85% Hemoglobin. 4,070,000 red blood cells. Color index 0.94. White count 4,650 of which 43% were polynuclears 43% small and 12% large lymphocytes, 2% eosinophiles.

Bleeding time 2½ minutes.

Coagulation time 5–6 minutes.

Blood Wassermann negative.

Prof. Wherry who took great interest in the case and conducted his own experiments, reported as follows:

"The swabs were stained pink with the mercurochrome which had been used in the eye that morning. In spite of this, the material when inoculated subcutaneously into a guinea pig killed it on the 6th day. Passage from this first pig to a second killed it on the 4th day. In neither of the pigs were the foci of necrosis in the liver and spleen very well developed, although they were more easily visible in the second pig. However the glandular involvement was typical—hard, white, swollen glands surrounded by a sero-gelatinous and hemorrhagic exudate. Smears from the pigs showed large numbers of B. tularense and they were cultivated from the spleen of the first pig.

"The vaccine was made by suspending the organism in 0.9% sodium chloride solution containing 1–100 formalin for twenty-four hours, centrifuging and resuspending in 0.9 Na Cl containing 0.5% carbolic acid. The vaccine was only faintly cloudy. Cultures of vaccine (aerobic and anaerobic) were negative, and I am inclined to think that this short treatment for formalin failed to detoxicate it and we got a specific reaction as in the case injected by Dr. Fred Lamb" (Case 3 above)

Blood taken December 6th in a Keidel tube and mailed to Dr. Francis was reported by telegram to be strongly positive for tularemia in a dilution of 1280.

December 22 (41 days after onset). Patient returned for examination and the following notes were made:

The right arm at the site of injection presents an area of induration, redness and swelling which is roughly three *cm* in diameter, non-tender and non-fluctuating. The left thumb is healed with a very slight scar. The axillary gland

is unreduced in size and very slightly tender. The preauricular gland is enlarged and slightly tender. The submaxillary glands are as enlarged as on discharge from the hospital, but not tender. The cervical glands are not enlarged.

The right eye is watery due to the stenosis of the lacrimal duct. The bulbar conjunctiva is slightly red and redundant, especially in the upper lid at the outer canthus. Near the limbus at 12:00 o'clock at the site of the large nodule already described is a slightly yellowish infiltration. Similar infiltration on the nasal side and on the temple side below. The cornea is perfectly clear.

The left vision is $\frac{20}{20}$.

With +0.37 cyl. ax. 60 right vision is $\frac{20}{20}$- and can read Ja. #1 right or left.

Von Graefe's prism test for muscular imbalance was negative.

Ophthalmoscopic examination of each eye was negative.

Comments: In all I have been able to find but six cases of tularemia conjunctivitis in the literature. Dr. W. G. Gillett, Wichita, Kansas, in a personal letter stated that he has a case which is to be reported in detail in the near future.

It is possible that because there was constant epiphora due to a stenosed lacrimal duct, the patient was in the habit of wiping her eye and that in this way the virus was transferred from the infected rabbit. An unusual and hitherto unreported condition was the presence of a limbal nodule which encroached on the cornea. The patient's rapid recovery may be attributed in part to the hot magnesium sulphate and sodium chloride fomentations.

The fact that inoculation from a conjunctival scraping (taken December 7th) did not kill guinea pig #3 proves that sometime between November 26th and December 7th the bacilli had disappeared from the epithelial cells.

In the diagnosis Parinaud's conjunctivitis and Conjunctivitis Infectiosa Necroticans (Pascheff) had to be considered. Parinaud's was excluded because of the acute course and general reaction; and Conjunctivitis Infectiosa Necroticans (Pasche) because I believe that the latter is exactly the same disease as tularemia conjunctivitis. This opinion has already been expressed by Prof. Wherry.[1]

[1] Stark, H. H. *Sect. on Ophth. A. M. A.*, 1924, *Discussion*, p. 60.

AN ACUITY APPARATUS WITH ATTACHMENTS FOR TESTING THE LIGHT AND COLOR SENSE AND FOR COLOR MIXING.

By Dr. C. E. FERREE and Dr. G. RAND, Bryn Mawr College.

(With one illustration in the text and two on Text-Plate XV.)

Synopsis.

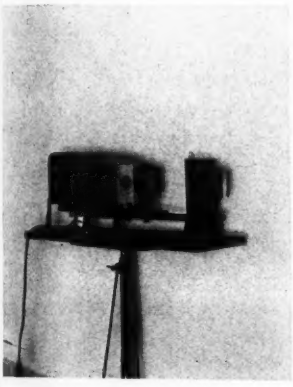
THE apparatus described has the following features: (a) Any acuity object, acuity chart, astigmatism chart, tangent screen, etc., may be uniformly illuminated over its entire surface and the illumination varied in finely graded steps from high to low without any change in the color of the illuminating light. (b) By means of a slight modification which may be quickly made, the apparatus can be converted into a device for changing in very finely graded amounts the size or visual angle of the test object over a wide range. This change in size can be made throughout the entire range, if desired, without any change in the intensity of light; or the intensity of illumination for any size of test object may be varied from high to low in a continuous series without any change in the color of the illuminating light. (c) The apparatus may be used for testing the light and color sense. (d) It may be used as a mixer for filter colored lights. Also by means of it the saturation and brightness of a single color or mixture of colors may be varied independently.

Several needs have served as an incentive for devising an apparatus of the kind to be described. (1) There is great need to be able to test acuity over a wide range of intensity of illumination. Eyes which are rated the same or approxi-

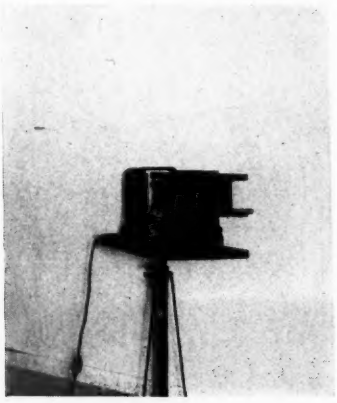
mately the same at high illumination, for example, may be rated very differently at low illumination. In rating eyes for vocational fitness, therefore, they should be tested as nearly as possible at the intensity of illumination at which the work is to be carried on. The Navy has felt this need in the selection of its men for the lookout work at night and the Air Service in its selection of night fliers. Furthermore there is need to provide for testing at low illuminations in the diagnosis of errors of refraction by the acuity method. Smaller defects of refraction and smaller errors in the correction of a defect can be detected at low than at high illuminations. Two reasons may be given for this:—(a) The focussing power of the contracted pupil at high illumination prevents a great deal of the blurring of the image that would occur with the same defect of refraction with the moderately expanded pupil found at the lower illuminations. And (b) a part of the blurring due to the error of refraction is compensated for by the greater power of the retina to discriminate detail at the higher illuminations. What we have called the superior focussing power of the pupil at high illuminations is due to the fact that the small pupil narrows the beam of light which emerges from each point in the object and which must be brought back to a point in forming the image, and thus reduces the size of the diffusion circles due to faulty focussing. The effect of the small pupil is to mask the defect so far as the influence on clear seeing is concerned, and therefore to lessen the ability to detect it by means of any test based on clear seeing. A pupil too widely expanded is not desirable either. By throwing into function the refraction defects usually found in the periphery of the lens, it causes too great a blurring of vision to permit of the best possible sensitivity in the use of any test based on clearness of seeing.

(2) If a convenient means is provided for changing the intensity of illumination in a continuous series or in finely graded steps, the illumination scale as an indicator or detector may be combined to advantage with the visual angle scale in the correction of errors of refraction by means of the acuity test. For example, when the $\frac{5}{5}$ line on the chart has been read and no correction can be made that will permit of the reading of the $\frac{4}{5}$ line or any part of it, many steps may be inserted between the

ILLUSTRATING ARTICLE OF DR. C. E. FERREE AND DR. G. RAND ON, "AN ACUITY APPARATUS WITH ATTACHMENTS FOR TESTING THE LIGHT AND FOR COLOR MIXING."



A.



B.

FIG. 2.

acuities represented by these two lines at a given intensity of illumination by reducing the illumination in small steps. In such a case the glass which enables the reading of the $\frac{8}{8}$ line at the lowest illumination should be accepted as the best correction.

(3) Intensity of illumination and a convenient and accurate means for its control are important factors also in the use of astigmatism charts. While as stated above, the acuity test is much more sensitive at low than at medium and high illuminations for the detection of errors in refraction or in their correction, the converse is true, for example, of the radial line chart for astigmatism. Such charts can be used with much greater sensitivity for determining the amount of an astigmatism or the exact placement of its correction at high than at low or medium illuminations. The details of this and the explanation will be given in a later paper.

(4) There is great need both in laboratory and clinic work for an instrument by means of which small changes may be made in the size of a variety of test objects of the more improved types,—also that there be provided in the same instrument the possibility of varying in sufficiently small amounts the intensity of the light by which these objects are illuminated. Such an instrument would present the possibility of using the visual angle and the illumination scales in separation or in conjunction as the needs of the work require. Also charts of the Snellen type could be used, or single test objects such as the broken circle, the opening of which could be turned at will in different directions in order to impose an objective check on the judgment. When provided with these controls, too, the broken circle can be used with great facility in the very sensitive test for astigmatism described by us a few years ago (1),—the former to provide for the different sizes of test object needed for eyes of different acuities, the latter to give the small variations of illumination needed to detect the differences in the resolving or image-forming power in the normal and astigmatic meridians.

(5) Length of exposure also is an important factor in the results obtained with the acuity test. Unless the length of exposure of the test object is subjected to control a close reproduction of results for any given set of conditions can

hardly be expected. Moreover, when needed great sensitivity can be added to the acuity test by decreasing the time of exposure. The limit of this procedure is reached when the minimum amount of time required to discriminate a given detail is determined. The result thus obtained is called the speed of vision. Speed of vision is one of the eye's most important functions. It is of paramount importance in rating the eye's fitness for different vocations and it affords an extremely delicate means of differentiating between favorable and unfavorable working conditions for the eye. Its diagnostic value has already been indicated. It should be given a prominent place in any program of visual tests.

And (6) there is a need particularly in office and clinic work for a feasible and quick means of determining achromatic and chromatic sensitivity.

The present apparatus devised to satisfy these and other requirements has the following features. (1) Any acuity object, acuity chart, astigmatism chart, or other test surface within certain limitations of size, may be uniformly illuminated over its entire area and the illumination varied in finely graded steps from high to low without any change in the color of the illuminating light. (2) By means of a slight modification which can be quickly made, the apparatus can be converted into a device for changing in small amounts the size or visual angle of the test object over a wide range. This change can be made throughout the entire range, if desired, without any change in the intensity of the illuminating light, or the intensity of illumination for any size of test object may be varied from high to low in a continuous series without any change in the color of the illuminating light. (3) By means of shutters similar to those used in photographic cameras the length of exposure of the test object can be held constant or varied over a considerable range. And (4) the apparatus may be used to test the light and color sense. It also may be used as a mixer for colored lights obtained from filters and as a device for varying independently their saturation and brightness.

The need for evenness of illumination in testing acuity is obvious. Important for making the test at any intensity of illumination, it becomes a necessity at the lower illumin-

ations because of the increased effect of differences of intensity on acuity at these illuminations. The even illumination of a test chart has been, we scarcely need to point out, one of the traditional problems of acuity testing. While it is difficult if not impossible, to illuminate uniformly a surface of any considerable size directly or indirectly from one or more sources of light, it is not especially difficult to illuminate evenly a surface of small size by devices which are feasible and to project the magnified image of this surface on a larger one. This principle is used in the present apparatus. A small aperture of the desired shape and dimensions is illuminated uniformly and its magnified image is projected on the surface to be illuminated. This use of an image for the purpose of illumination paves the way also for the solution of the second problem, namely, the obtaining of finely graded changes of intensity without change in color of light. That is, any variation in the size of aperture of the projection lens employed changes the intensity of the light in the image formed without altering the evenness of distribution of light or changing the size or shape of the image. A convenient means of producing regular and known changes in the size of the aperture is an iris diaphragm placed as near as possible to the front or back surface of the lens. The principles outlined here were embodied in an illuminating device which we described a few years ago, called an acuity lantern (2). In the present apparatus the method of applying these principles has been changed for the following reasons. (1) A wider range of intensity of illumination was needed than could be obtained with the former apparatus. (2) A form of apparatus was wanted which could be used not only as a means of illuminating over a wide range of intensities, existing test objects and test charts graded to a fixed scale of sizes or visual angles; but with a slight modification could be used both for varying the size of the test object and the intensity of light with which it was illuminated. And (3) for convenience and cheapness of manufacture a device was wanted which could be used as an attachment or modification of apparatus the parts of which the manufacturer is already equipped to make. Since the Bausch and Lomb Optical Co. had arranged for the manufacture of the original apparatus, it was decided to make the enlarged apparatus a modification of

the Bausch and Lomb balopticon. A representation of the optical system of the apparatus is given in Fig. 1. The source of light is a high power tungsten lamp. This lamp is placed at the principal focus of a collimating system made up of two plano-convex lenses L1. At a suitable distance in front of these lenses is a frame in which are inserted as wanted plates containing the apertures which are to be imaged on the surface

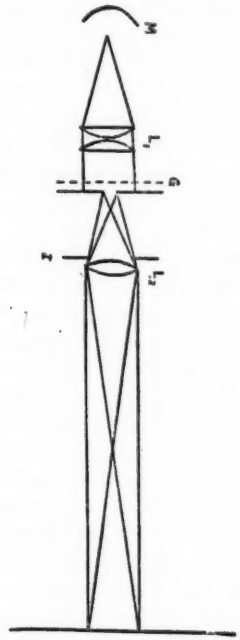


Fig. 1.

to be illuminated. Between the collimating system and the aperture to be illuminated is a thin plate of ground glass G to diffuse the light and to aid in providing the needed uniformity of illumination of the aperture. This plate is placed at a sufficient distance behind the aperture to eliminate all traces of mottling in the image which would occur were its illuminated surface imaged on the test chart. Other features which ensure evenness of illumination of the aperture are (a) an etched concave mirror M placed behind the source of light

which adds a component of diffused light to the collimated beam, and (b) the size of the aperture which is so small as to receive light only from a central and more homogeneous portion of the beam. The smallness of size of aperture is due to the fact that the lantern is operated at a distance of 6 meters from the surface to be illuminated. Subjected to the magnification consequent upon this distance, the size of aperture needed to illuminate one or more lines of an acuity chart or even the whole chart is very small. The image is formed on the surface to be illuminated by a projection lens L2 of suitable diopter value. Just back of this lens is the iris diaphragm furnished with a pointer and a scale calibrated in illumination units.

In order to accomplish the second feature, change in size of test object, the projection principle is also utilized. That is, the test object is magnified or minified by projection in order to give the desired changes in size. The test object is in the form of a lantern slide placed in the beam of light between the projection lens, which should be corrected for spherical and chromatic aberration, and the aperture illuminated by the condensing system with its diffusing plate. In order that such test objects as the broken circle may be rotated to present the opening to be discriminated in different directions, the frame which holds the lantern slide is attached to a ring which rotates in a collar. The test object, however, may be anything that is desired, a Snellen chart or any part of it, an astigmatic chart, etc. A photograph of the apparatus with a broken circle as test object is shown in Fig. 2, A.

In producing changes of size by projection, two problems are presented. (1) The projection must be made with a fixed distance of screen to receive the image; and (2) the change of size produced by minification or magnification of the image of the test object must be accomplished ***without any significant change in the light density of the image.*** In accomplishing both of these features the eye has been used as a model. In case of the eye (a) the retina receives its image at a fixed distance from the refracting system regardless of the distance of the object; and (b) changes of size of image produced by changes in the distance of the object do not cause changes of density of light in the image, provided that a constant size of

aperture of lens or pupil is maintained. The former of these results, namely a fixed distance of screen from the refracting system, is made possible by changes in the diopter value of the lens as an accommodation for the distance of the object; and the latter is in accord with the following principle. As the distance of the object from the eye is changed both the amount of light entering the pupil and condensing into the image, and the size of the image vary in the same relation. That is, as the object recedes from the eye the amount of light entering the pupil decreases as the square of the distance of the object and the size of the image over which the light distributes decreases also as the square of that distance: a corollary of the fixed distance of image and variable distance of object. These compensating changes serve *to keep the intensity of light in the image constant as the distance of the object is changed.*

In making this statement in reference to the eye we are aware of its approximate character. The law is strictly true only of thin lenses. Its validity is accepted within quite wide limits however by the photometrists in the measurement of the brightness of surfaces. Also in case of our apparatus, comparatively thin lenses are used and the changes in the distance of the object are extremely small. The total range of change will probably not exceed 3 or 4*cm.*[1]

In order to produce the changes of distance required to give the small changes in size of image needed, the lantern slide holder is mounted on a slow-motion rack and pinion. The changes in the strength of lens needed to focus the image on the screen at a constant distance are produced by placing lenses of a suitable gradation of strength behind the focussing lens. The magnitude of change of size produced depends on the ratio of strength of the projection lens to that which is added as an accommodation for distance. As this ratio is increased, the size of the steps in the series is decreased, and conversely. The lenses needed to serve the purpose of accommodation may

[1] The principle which is embodied in our apparatus is the only one, so far as we know, by means of which changes in the size of the test object can be made by projection without changing the intensity of light in the image formed. If changes in size of test object are to be accompanied by changes of intensity of light, it is quite obvious that size of object or visual angle cannot be taken as the measure of acuity.

be obtained in stock sizes varying by ⅛ diopter over a considerable range of strengths. They may be rotated into position by a suitable mechanism, or more simply, they may be dropped into a groove or holder just back of the projection lens and in close contact with it. By using different strengths of the stock sizes, varying from ⅛ to 1 diopter for example, in connection with a 5 diopter projection lens, changes in the size of the image may be produced of the order of 0.02–0.03. By using a larger diopter value of projection lens these changes may be made slightly smaller still. A finely graded series of sizes can be secured for a single test object, *e.g.*, the broken circle, the opening of which can be rotated in different directions to impose an objective check on the judgment, by providing certain fixed sizes in the form of lantern slides and filling in between by a means of a selected series of lenses. If a Snellen chart, already provided with a fixed scale of sizes, is used as lantern slide, small changes in size may be inserted between those presented by each of the lines on the chart by the use of a suitably selected series of lenses. Astigmatism charts may also be projected as test objects and their sizes varied if desired in the same scale of relation.

As before the intensity of light in the image may be varied by means of the iris diaphragm located just behind the projection lens. At first glance this might seem to involve a difficulty not present in the use of the apparatus as an illuminating device, namely the influence of the size of the pupillary aperture on the clearness of imaging. This influence is of practical importance, however, only when a blurred image is present. When spherical aberration is eliminated by the use of a corrected projection system and an exact focus is obtained, changes in the size of the pupillary aperture do not seem to change noticeably the clearness of the image formed. That is, a reduction in the size of the pupil to the point at which diffraction becomes effective exercises a great deal of influence on clearing up an image blurred by spherical aberration, astigmatism, faulty focussing, etc.; but its effect on a clear image obviously should be negligible.

The use of an apparatus of this type for the testing of achromatic and chromatic sensitivity is described in former papers (3). These sensitivities are determined by finding the

minimum amount of colorless and colored light needed to arouse the achromatic and chromatic sensation. All that is required for this purpose is to reduce the projected image to the size that is desired and decrease the light to threshold intensity. The reduction in the size of the image is accomplished by reducing the size of the illuminated aperture the image of which is projected on the screen. Colored light is obtained by means of filters inserted in the holder at the end of the projection tube. This holder is provided with three grooves for the filters and with a collar which slips over the end of the projection tube. The filters prepared by the Eastman Kodak Co. or the Wratten-Wainwright filters may be used conveniently for this purpose. The transmission of these filters for the different parts of the spectrum is known.

Earlier in the paper it is stated that the apparatus may be used also to mix colored lights obtained with filters and to vary independently the brightness and saturation of a colored light. In order to allow for this the filter holder noted above is provided with two horizontal tracks or grooves, one just in front of the other. These tracks are just behind the vertical grooves in which the filters are inserted for testing color sensitivity and immediately in front of the projection lens. In each of these tracks moves a carrier in which may be inserted the appropriate screen or filter. Each of the carriers is operated by a fast motion screw. By means of these screws either of the carriers with its filter can be made to travel back and forth across the beam of light. By varying the amount of this motion the proportion of the beam colored by each filter may be varied at will in a continuous series of changes and the two colors may be mixed in any desired proportions. A component of white light may be mixed with the colored light by adjusting the position of the two filters so that the beam is divided into three sections, two colored and an intermediate colorless sector. By varying the width of these sectors the proportions of color and white in the mixture may be changed at will.

If it is wanted to vary the saturation and brightness of a single color independently of each other, an opaque screen is substituted for one of the filters. By varying the amount and proportion of the beam intersected by this screen and the

filter, the amount and proportion of the white and colored light in the mixture may be varied at will; and by properly selecting these proportions the saturation of the color may be varied and the brightness be held constant or, conversely, the brightness may be varied and the saturation be held constant.

In order that the setting of either screen or filter may be reproduced and to provide for calibration, the filter holder is provided with two graduated scales, one at the top and one at the bottom. A pointer at the forward end of one of the filter carriers travels over one of these scales and a second pointer at the forward end of the other carrier, travels over the other scale.

The mixing takes place on the principle that each point in the image receives light from every point in the lens; therefore the insertion of a colored filter over any part of the lens results in a uniform coloration of every part of the image. This, so far as we know, is the only way in which the mixing of colored lights, obtained by means of filters, can be conveniently and satisfactorily accomplished from a single source of light. The method is a corollary of the method we have used to secure the uniform illumination of a surface from a single source of light, namely the uniform illumination of a small aperture and the projection of its magnified image on the surface to be illuminated. When this is done the light coming from any part of the lens is uniformly distributed in the image. As many colors can be mixed by this method therefore as means can be provided for inserting and moving the filters across the beam of light at the front or back surface of the lens. A photograph of the apparatus provided with the color mixing attachment is shown in Fig. 2, B.

REFERENCES.

1. C. E. Ferree and G. Rand: "Sensitivity of Illumination Scale for Determining Exact Amount and Placement of Correction for Astigmatism," *Amer. Jour. Ophthal.*, Jan., 1921, IV; "Some Contributions to the Science and Practice of Ophthalmology," *International Congress of Ophthalmology*, Washington, D. C., 1922, 410–415.
2. C. E. Ferree and G. Rand: "Lantern and Apparatus for Testing the Light Sense and for Determining Acuity at Low Illuminations," *Amer. Jour. Ophthal.*, 1920, III, 335–341; "Some Contributions to the Science and Practice of Ophthalmology, *International Congress of Ophthalmology*, Washington, D. C., 1922, 407–410.

3. C. E. Ferree and G. Rand: "An Apparatus for Testing the Light and Color Sense," *Amer. Jour. Ophthal.*, Nov., 1920, III; "Some Contributions to the Science and Practice of Ophthalmology," *International Congress of Ophthalmology*, Washington, D. C., 1922, 415–417.

LATE RESULTS OF INTRACAPSULAR CATARACT EXTRACTION.[1]

BY DR. ARNOLD KNAPP, NEW YORK.

WITHOUT taking up the question of vitreous loss it is stated that the intracapsular cataract operation unduly traumatizes the eye, displaces the pupil and sets in action degenerative changes in the vitreous which result in ultimate damage to the eye; some even claim that the posterior capsule should be retained as it serves as an important support for the vitreous. These questions can best be answered by the examination, after a number of years, of eyes in which an intracapsular extraction had been performed.

For this purpose I have followed up and reëxamined as many as possible, of the 200 successive intracapsular cases, which were operated on by me between 1910 and 1919. These cases were all extracted by the method of preliminary subluxation with the blunt capsule forceps and were described in detail in the ARCHIVES OF OPHTHALMOLOGY in 1915 and 1921.

The following report gives the late results in 85 cases as to vision and to changes in the structures of the eyeball, particularly in the vitreous.

Results: Of these, 16 cases have died; vision, at last examination or from report of relatives, had remained good. In 57, vision was found to be as good as after operation or had improved; in 5 of these there had been slight vitreous loss.

In these 57, the cornea was perfectly clear; the coloboma

[1] Read at Convention of English-Speaking Ophth., London, July 14–17, 1925.

was generally regular and there was no updrawing of the pupil, except in a few where the pupil was slightly distorted from posterior synechia, from anterior adhesion of one pillar, prolapse of iris or of vitreous loss without affecting the vision.

In the pupillary area the vitreous usually presented in the form of a membrane distinctly seen with the slit-lamp so that it seems to me to be quite proper to speak of a hyaloid. This membrane sometimes bulged forward like a wavy globular mass, or it presented as a more or less flat membrane at or posterior to the level of the pupillary margin. It was either intact, covered with a number of fine brown dots, or there were one or more irregular holes, through which the vitreous presented in irregular masses (in these cases there was no question of vitreous loss at operation). This membrane was absent in cases with vitreous loss. Back of this hyaloid membrane, the slit-lamp revealed a definite gap before the limiting vitreous structure was seen.

The conditions for the examination of the vitreous in these intra-capsular cases are naturally perfect and the vitreous was found unusually clear. A slight haze after operation disappeared in a few weeks. There is no question that the vitreous is much more free from opacities in these cases than in the capsulotomy cases. This is to be expected by the greater freedom from irido-cyclitis and the absence of reaction which sometimes follows the discission. No changes were found in the deeper vitreous layers with the slit-lamp other than those described by Vogt as senile.

I was able to find only two references in the literature on the conditions of the vitreous after intracapsular operation, namely, Muñoz Urra (*Archivos de Optalmologia Barcelona*, XXII., Dec., 1922), and Elschnig (A. J. O., p. 355, 1925) who examined the vitreous with the slit-lamp after the Barraquer operation.

Muñoz Urra speaks of a "perfectly empty space remaining after total extraction. Immediately after operation small infiltrations produced by leucocytes can be seen which are due to slight attacks of cyclitis, but after the first week the vitreous is entirely normal. However, in some cases this vitreous infiltration lasts for a longer time. In a normal operation the infiltration disappears quickly and the transparency is after-

wards perfect. These small infiltrations do not prevent perfect vision. Sometimes the vitreous makes a small hernia through the pupillary opening. In this case pigment from the iris is seen on the surface of the hyaloid, where it remains forever."

According to Elschnig, "the vitreous almost always forms a rounded mushroom-shaped prominence which projects into the anterior chamber seldom covered by an intact vitreous membrane but generally by one that seemed to be riddled with small holes. Even in many cases in which no vitreous entered the anterior chamber free floccules of vitreous could be found as far forward as the posterior surface of the cornea. In all cases of extraction within the capsule but least in the Barraquer method, the vitreous membrane and the deeper vitreous layers seemed to be studded by veils, threads and pigment dots. Only further observations over a period of years can show whether such vitreous conditions are prejudicial to the integrity of the eye."

In three of my cases excessive proliferation of the vitreous projected into the anterior chamber through gaps in the hyaloid membrane. These masses were definitely cloudy but did not interfere with the patient's vision and in the course of years underwent but very little change. These cloudy proliferating changes are well known in capsulotomy cases where the capsular epithelium has been held responsible and which the above observation shows not to be the case.

Important complications in the ordinary cataract extraction with needling are *glaucoma* and *detachment of the retina.*

Glaucoma was found only in one of my cases that of R. 107 in whom six years after a successful extraction the patient presented herself with the signs of heterochromic iritis, optic atrophy and glaucoma. It is not definite that the glaucoma was referable to the method of operation. In two cases of chronic glaucoma and cataract, after extraction of the cataract in the capsule, the glaucomatous tension was relieved. It is perhaps worthy of comment in this connection to state that in chronic glaucoma the cataractous lenses are readily subluxated with the capsule forceps and that extraction in the capsule is easily performed. On the other hand, in a third case where the glaucoma also antedated the intracapsular

operation, glaucoma persisted after the extraction and required a secondary operation.

Detachment of the retina was not observed in a single reexamined eye.

Three cases of *retinitis pigmentosa* were operated on. The reëxamination showed no change but increased deterioration of sight and greater contraction of field.

Detachment of the choroid observed in a number of cases after operation never persisted.

Blood staining of the hyaloid from hyphema at the time of operation occurred in a number of cases and was unusual as the blood color in contact with the hyaloid remained unchanged for a long time, often for several months.

Inflammatory reactions on the part of the iris and ciliary body in these intracapsular cases presented the following changes: The pupillary margin becomes attached to the underlying hyaloid to a varying degree in the form of posterior synechia. The hyaloid shows corresponding faint opacities which may extend over the entire pupillary membrane, the pupil under these conditions is distorted and somewhat updrawn (3 cases). If the reaction is greater the cornea clouds or more correctly speaking the initial corneal opacity, the so-called keratitis striata, steadily increases (2 cases). There is only moderate ciliary congestion and the symptoms are not marked. The periphery of the cornea becomes vascularized, the pupil contracts and is updrawn, tension is not particularly affected. The clinical picture is rather that of a nutritional or degenerative process. One naturally asks whether traction on the ciliary processes in the subluxation maneuver and subsequent extraction is a factor. I do not think it is, if the eye is a normal one. In the two cases in which this occurred, the patients were old and feeble, and in one acute glaucoma had preceded the cataract for some years. In using the blunt capsule forceps one can gauge the amount of traction exercised on the ciliary processes, and it is my practice if the suspensory ligament does not readily tear, to desist and apply the toothed capsule forceps.

Fuchs in an article on "Erkrankung der Hornhaut durch Schädigung von hinten" (*v. Graefe's Archiv*, Vol. xcii, 1916, p. 145) on page 208 speaks of sclerosis of the cornea in old

people after operations. The opacity of the cornea was superficial, suggestive of epithelial dystrophy and in the later stages clouding occurred from lamellar deposits on the cornea. In other cases swelling (Quellung) of the corneal lamellæ took place rarely with hyaline deposits. Fuchs regards the clinical cause of this sclerosis to be a nutritional disorder after intraocular inflammation or operation. While one case developed corneal dystrophy as was reported in the original paper, the cases to which I have just referred to and which numbered two, the opacity of the cornea was deep and there were no superficial changes in the corneal epithelium.

In general on looking over the *late results* after this form of intracapsular extraction it seems that if the primary result is good, excellent vision is retained as the cases show that were reëxamined from 10 to 15 years after operation and that the patients have surprisingly little trouble from their eyes. There is no evidence of degeneration of the vitreous which led to pathological changes in the eyeball. The freedom from vitreous disturbance in these cases shows the correctness of the belief that occasional but definite reaction and damage to the eye occur from retained capsule and cortex or from one or more needling operations. There is a remarkable freedom from glaucoma, from retinal detachment and from the sequellæ of iridocyclitis except for the serious but fortunately rare complication of sclerosis of the cornea.

PUPILLOSCOPIC FINDINGS IN LESIONS IN DIFFERENT PARTS OF THE REFLEX ARC.[1]

By Dr. FRANCIS HEED ADLER, Philadelphia, Pa.

(With five illustrations in the text.)

IN 1921 Groethuysen (1, 2) published a paper on the use of the Hess pupilloscope, in which he presented the theoretical results one should obtain in various lesions of the pupillary pathways. The actual findings in clinical cases were cited in support of these theoretical considerations.

The Hess pupilloscope is best known in this country through the work of Dr. Otto Barkan (3), and reference should be made to his papers, or to the papers of Hess (4) and Groethuysen for a complete description of the instrument and its uses. For the purposes of this paper it is necessary to emphasize that this instrument measures the threshold value of the light reflex. It is evident that when an eye is adapted for any particular degree of illumination, it will be necessary to increase the illumination by a definite minimal amount in order to produce a reaction of the pupil. The smallest difference in intensity between two lights which brings about this reaction is the threshold value of the reaction and when measured with the pupilloscope is spoken of as the motor discriminative acuity or abbreviated, the M. D. A. Groethuysen found that for the normal eye the minimal difference in intensity between two lights must be as 95:100, or expressing this as a quotient, the M.D.A. = 0.95. The values for the M.D.A. are always expressed as a quotient and the lowest physiological quotient is about 0.84. Any quotient lower

[1] Read before the Section on Ophthalmology of the College of Physicians of Philadelphia, January 21, 1926.

than this signifies a pathological condition. With the same instrument one may determine the minimal difference between two lights which can be detected by the patient. This threshold value is spoken of as the Visual Discriminative Acuity, or abbreviated the V.D.A. The values are also expressed as a quotient, and are found to be the same as the M.D.A. for the normal individual.

Groethuysen presented the following table to illustrate the relation of the motor discriminative acuity (M.D.A.) to the visual discriminative acuity (V.D.A.) in lesions of different parts of the reflex arc.

TABLE I.

GROETHUYSEN. *Arch. f. Augenheilk.* Vol. 87

DAMAGE TO	M.D.A.	V.D.A.	CONVERGENCE REACTION
Sensory fibre	Reduced	Reduced	Normal
Intercalated fibre	Reduced	Normal	Normal
Motor Pathway	Reduced	Normal	Reduced

From this data one may obtain certain information regarding the probable situation of any lesion affecting the pupillary reflexes. In order to locate with more precision the site of any lesion one must make use of the reaction of the pupil to direct light and the consensual reaction, both of which may be determined numerically with the pupilloscope. Finally the state of the associated reflexes of the pupil must be determined, as for example the accommodation-convergence reaction of the pupil. This latter cannot be measured in terms of threshold value with this instrument, and we must be content to note its presence or absence in any case.

Groethuysen and others have studied the M.D.A. for the direct and consensual reactions in lesions of various parts of the reflex arc, and have claimed that the data afforded by the use of the pupilloscope is of greater diagnostic value than the ordinary routine tests. Groethuysen (2) particularly emphasizes the fact that he can locate more than one lesion in the same pupillary pathway, and even multiple lesions in the pathways for both eyes.

The fact that our anatomical knowledge of the afferent

pathway for the light reflex is still incomplete is sufficient to negative any such claims of accuracy in localization.

Some schematic representation of the pathways must be adopted in order to visualize the probable site of a lesion giving reduced pupilloscopic quotients. The following schematic illustration shows the afferent and efferent pathways based on the experimental work of different investigators and differs from that given in Groethuysen's paper and in most text books in that the afferent pupillo-motor fibres do not decussate in the chiasm (1). There is definite proof of the

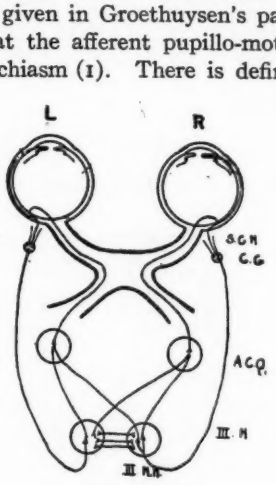


FIGURE 1.

S.C.N. = Short ciliary nerves.
C.G. = Ciliary ganglion.
A.C.Q. = Anterior corpus quadrigeminum.
III N. = Ocular motor nerve.
III N.N. = Ocular motor nucleus.

partial decussation of the visual fibres and it has been assumed that the pupillo-motor fibres do so likewise. This assumption, however, is based upon the histological evidence of Cajal (5) and of Van Gehuchten (6) and it is not possible to determine whether the fibres examined histologically are visual or pupillo-motor. In 1898 Bernheimer (7) showed from a series of clinical cases and from experiments in monkeys that even though the chiasm be cut through in a sagittal section, the consensual light reflex persists. Recently Hartridge (8) has con-

firmed this. It is certain therefore that a crossing of these fibres does take place in back of the chiasm, and other evidence suggests that this is in the intercalated fibres running from the anterior corpus quadrigeminum to the third nerve nuclei of both sides. This does not of course disprove the existence of a decussation at the chiasm, but it makes it unnecessary to assume such. It would seem advisable therefore to eliminate the crossing at this site. There is good evidence that the visual and pupillo-motor fibres separate before reaching the primary optic centers, for extirpation of the external geniculate body leaves the pupil reactions unimpaired (9). The actual course of the pupillo-motor fibres from the optic tract to the mesencephalic center is still uncertain but it seems fairly certain that the anterior corpora quadrigemina receive these fibres and a new neuron proceeds to the motor-nuclei of each side. Karplus and Kreidl (10) found in cats that electrical stimulation of the optic tract (except where this enters the lateral geniculate body) along the superior brachium up to the superior colliculus results in a constriction of the pupil. This indicates that the pupillo-motor fibres proceed to the gray matter of the superior colliculus by way of the brachium. If the brachium of each side be cut the light reflex is lost, and Karplus and Kreidl (11) succeeded in producing a typical Argyll-Robertson pupil in the ape by this means.

The experiments of Ferrier and Turner (12) which are continually cited to disprove the participation of the superior colliculi in the pupillo-motor pathway are probably faulty. As Kinnier Wilson (13) remarks: "Their work cannot be taken to prove that the whole anterior colliculus may be destroyed without preventing the light reflex, both because of the limited number of animals in which the pupillary reflexes were investigated and the admitted difficulties in the way of testing, and because in view of the uncertain path of the light reflex fibres from brachium to oculo-motor nucleus no adequate proof is forthcoming from the experiments that these fibres could not have escaped."

Karplus and Kreidl's (11) experiments in cutting the brachium, on the other hand definitely prove that the pupillo-motor fibres run to the anterior corpora quadrigemina.

The course of the fibres from this point on to the oculo-

motor nuclei is still more uncertain, but it is hardly to be doubted that a semi decussation of these intercalated fibres takes place to both third nerve nuclei.

1. Pupilloscopic findings in a lesion of the Sensory Fibre.

In this, as in all the following illustrations the lesion is depicted on the left side. Where the arrow crosses one or

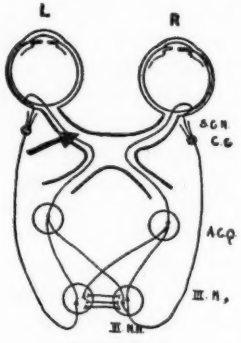


FIGURE 2.

S.C.N.	=	Short ciliary nerves.
C.G.	=	Ciliary ganglion.
A.C.Q.	=	Anterior corpus quadrigeminum.
III N.	=	Ocular motor nerve.
III N.N.	=	Ocular motor nucleus.

DISEASE OF THE SENSORY FIBRE LEFT EYE

	Right Eye	*Left Eye*
Direct Light Reflex.....	0.9	0.6
Consensual Reflex.....	0.6	0.9
Convergence Reflex.....	Present	Present

more fibres all are involved. The quotient for the M.D.A. in all cases for simplicity is given as 0.9 for the normal value and 0.6 for a reduction. Groethuysen lays stress on the quantitative differences in the reduction on the two sides, but an analysis of the site of a lesion based on small differences of this sort is highly unreliable.

When a sensory fibre is damaged as in progressive optic atrophy there will be a reduction in the motor and also in the

visual discriminative acuity. The M.D.A. and V.D.A. will usually be reduced by an equivalent amount, and reduction proceeds in each parri passu.

2. Damage to the intercalate fibre on one side.

It is unusual to find a lesion involving the intercalated fibres on one side only; usually there is also some involvement of the opposite side, which also yields a slightly lowered M.D.A. Assuming however, that the left side is damaged, whereas the right side is entirely normal, we find the following:

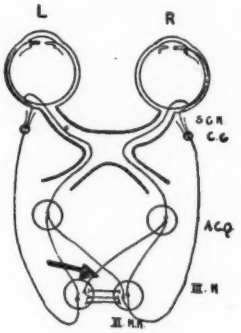


FIGURE 3.

S.C.N.	=	Short ciliary nerves.
C.G.	=	Ciliary ganglion.
A.C.Q.	=	Anterior corpus quadrigeminum.
III N.	=	Ocular motor nerve.
III N.N.	=	Ocular motor nucleus.

DISEASE OF INTERCALATED FIBRES LEFT EYE

	Right Eye	*Left Eye*
Direct Light Reflex.....	0.9	0.6
Consensual Reflex.....	0.9	0.6
Convergence Reflex	Present	Present

3. Damage to the intercalated fibres of both sides.

The changes resulting from such a lesion give the typical Argyll-Robertson pupil. The question may arise whether it is proper to speak of a pupil which still responds to light,

however slightly as a typical Argyll-Robertson pupil. By some it may be said that the light reflex, both direct and consensual, must be lost before one can speak of a typical Argyll-Robertson pupil. It is not uncommon, however, to observe a typical Argyll-Robertson pupil in one eye with a pupil still

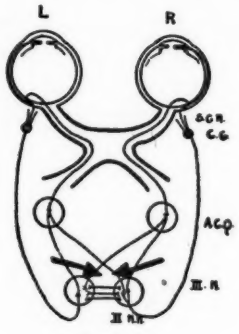


FIGURE 4.

S.C.N.	=	Short ciliary nerves.
C.G.	=	Ciliary ganglion.
A.C.Q.	=	Anterior corpus quadrigeminum.
III N.	=	Ocular motor nerve.
III N.N.	=	Ocular motor nucleus.

DISEASE OF THE INTERCALATED FIBRES BOTH EYES

ARGYLL-ROBERTSON PUPILS

	Right Eye	*Left Eye*
Direct Light Reflex.....	0.6	0.6
Consensual Reflex.....	0.6	0.6
Convergence Reflex.....	Present	Present

perceptibly active to intense light in the other eye. In course of time this pupil also becomes inactive to light. If the reaction of the pupil to direct light is reduced, as tested with the pupilloscope and if the accommodation convergence reaction in that eye is present and the accommodation be normal for the patient's age (14), there cannot be any just doubt in pronouncing such a pupil a typical Argyll-Robertson pupil. It is perfectly true that the pupils originally described by Argyll-Robertson were totally inactive to light, but, as hap-

pens most frequently, the symptom was first described when well advanced. It is unthinkable that the damage causing an Argyll-Robertson pupil should bring about a complete loss of the reflex immediately. The damage must come on gradually and exhibit a stage of paresis before complete paralysis. Objections have even been raised to pronouncing a pupil, showing the characteristic reflex phenomena, a typical Argyll-Robertson pupil, unless the pupils show myosis. As Kinnier Wilson (13) points out the myosis is purely facultative and not obligatory, even though all of the cases described by Argyll-Robertson himself showed this feature. It is in the early paretic stage that the pupilloscope is of value. With such measurements there need be no doubt as to whether the reaction of the pupil is normal or not. The reduction can be measured and the progress of the disease determined from time to time, and the effect of treatment noted.

4. Damage to Efferent or Motor Pathway.

Groethuysen (1) considered that damage to any part of the efferent pathway would reduce the motor discriminative acuity. It is conceivable that this is true when the third nerve nucleus is affected. One may think of the nucleus as a mechanism which liberates a motor impulse when it receives a stimulus of threshold value or greater. If the nucleus be diseased the threshold will have to be increased in order to bring it into action. If the damage be confined to the nerve endings on the other hand it is possible that the motor discriminative acuity will remain normal, for the nucleus continues to send out the impulse under normal threshold stimulation; but the amplitude of response of the sphincter muscle will be diminished in proportion to the degree of block.

In order to test whether this was so, a series of normal individuals receiving homatropine for refraction were examined with the pupilloscope. Homatropine causes a gradual paralysis of the third nerve endings and therefore produces a gradually developing block to the passage of the impulse to the sphincter muscle.

The motor discriminative acuity was determined in the usual way with the Hess pupilloscope. After the first determination one drop of a 2% solution of homatropine hydro-

bromide was instilled in each eye. The M.D.A. was determined at five-minute intervals until the pupils no longer responded. It was found that this value remained the same within the limits of the usual variations until the iris no longer responded. The amplitude of the constrictions, however, gradually diminished, showing the increasing effect of the block.

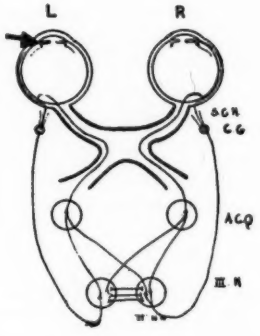


FIGURE 5.

S.C.N. = Short ciliary nerves.
C.G. = Ciliary ganglion
A.C.Q. = Anterior corpus quadrigeminum.
III N. = Ocular motor nerve.
III N.N. = Ocular motor nucleus.

DISEASE OF THE NERVE ENDINGS SPHINCTER MUSCLE LEFT EYE

	Right Eye	*Left Eye*
Direct Light Reflex.....	0.9	0.9
Consensual Reflex.....	0.9	0.9
Convergence.....	Reduced amplitude	Present.

We can say from this that damage to the nerve endings does not diminish the motor discrimination acuity but results in a gradual decrease in amplitude of the constriction, until the pupil does not respond. Occasionally one may see fibrillary twitchings of that part of the iris where the sphincter muscle is imbedded, which are too weak to move the pupillary margin.

It is impossible to say whether damage to the third nerve

itself or to the ciliary ganglion will leave a normal threshold value, or whether it will be reduced. The latter might be tested by applying nicotine to the exposed ciliary ganglion in anæsthetized or decerebrate animals.

TABLE SHOWING VALUES FOR M.D.A. DURING HOMATROPINE MYDRIASIS.

	A.S. M. 24 11/25/25 M.D.A.		F.D. Fe. 18 11/21/25 M.D.A.		F.K. Fe. 37 11/16/25 M.D.A.		A.G. M. 19 11/12/25 M.D.A.		J.B.B. M. 24 12/17/25 M.D.A.	
Minutes after homatropine	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*	*Right*	*Left*
	.85	.92	.92	.92	.72	.92		1.0	.92	
0	H	H	H	H	H	H		H	H	
5′	1.0	1.0						1.0	.92	
10′	1.0	.92			.91	.91		.93	.84	
15′	H	H	.92	.92	H	H		.92	H .92	
20′			P.F.	P.F.	.92	.91		.92	.92	
25′					P.F.	P.F.		P.F.	.92	
30′	P.F.	P.F.							.92	
35′									P.F.	
40′										

H = Instillation 1 drop 2% Homat.
P.F. = Pupil fixed.

SUMMARY.

The pupilloscopic findings in lesions of various parts of the reflex arc are given based on a schematic representation of the pupillo-motor pathways. This differs slightly from that presented by Groethuysen in that damage to the third nerve endings has been found to result in a normal threshold value for the light reflex. This may be of clinical value in differentiating cases in which a lesion is suspected somewheres in the motor pathway.

REFERENCES.

1. Groethuysen, G. *Arch. f. Augenheilk.*, Vol. 87, 1921, p. 152.
2. Groethuysen, G. *Arch. f. Augenheilk.*, Vol. 88, 1921.
3. Barkan, Otto. *Arch. of Ophth.*, Vol. 51, 1922, p. 29.

4. Hess, C. *Arch. f. Augenheilk.*, Vol. 80, 1916, p. 213.
5. Ramon Cajal. *Histologie du Système Nerveux*, Vol. 2, p. 369.
6. Van Gehuchten. *Le Système Nerveux de L'Homme.*
7. Bernheimer. *Sitzungsber. de Skad. Wien*, Vol. 107, 1898.
8. Hartridge. Starling. *Human Physiology*, 3rd Edition, p. 512.
9. Parsons, J. H. *Transactions of the Ophth. Soc. U. K.*, Vol. 44, 1924.
10. Karplus & Kreidl. *Pfluger's Arch. f. d. ges. Phys.*, Vol. 129. Also *Ibid.*, Vol. 135.
11. Karplus & Kreidl. *Neurolog. Centralbl.*, Vol. 32, 1913, p. 82.
12. Ferrier and Turner. *Brain*, Vol. 24, 1901, p. 27.
13. Kinnier Wilson. *Jour. of Neurology and Psychopath.*, Vol. 2, 1921, p. 1.
14. Mehrtens & Barkan. *Arch. of Neurology & Psych.*, Vol. 10, 1923, p. 409.

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By Dr. DAVID H. WEBSTER, Secretary.

MEETING OF NOVEMBER 18, 1925. DR. CONRAD BERENS, CHAIRMAN.

Dr. GEORGE H. BELL presented a patient, aged 40, with a **Conglomerate Tubercle of the Choroid of the Right Eye.** There is a yellowish-white tumor in the macular region, measuring 3 x 2*mm* and with an elevation of 3D. Between this and the disk there are some choroidal changes suggestive of an old tuberculous process. The disk is hazy and there are a number of floating opacities in the vitreous. The reaction to old tuberculin in the eye, producing a hemorrhage at the upper border of the tumor, a local reaction in the skin and a slight rise of temperature, confirmed the diagnosis. The X-ray of the lungs shows an old chronic tuberculous process.

The patient has had up to this time 35 injections of "TR," and Dr. Bell proposes to go on with these injections, at the same time looking after the general hygiene of this patient, which includes the "Reform Diet." Personally, he thinks from now on this man would do better out in the country where he could get plenty of fresh air, sunshine, good fresh milk and green vegetables.

DISCUSSION: Dr. ROSE stated that he did not think that cases of tuberculosis should be sent to the country, as statistics show the health of New York City to be better than that in the country; these cases should be treated with tuberculin only, and if watched carefully could be best controlled. He had been in many sanitaria and investigated their treatment, but had found them of no special value in eye cases.

Dr. CHARLES LITTWIN showed (by invitation) a case of

Hole in the Disk, an anomaly of the optic-nerve head of infrequent occurrence, usually occurring coincident with some other pathological condition. The patient was a man, 37 years of age, colored, who came to Dr. Alfred Wiener's clinic, at St. Luke's Hospital, in April, 1924, complaining of reduced vision, and a feeling of sand in both eyes. Vision O.D. $\frac{20}{70}$, and O.S. $\frac{20}{50}$. Lids showed marked thickening, suggestive of old trachoma, and there was a pannus-like opacity in the cornea. Both disks were blurred and there was a large physiological cup. At the temporal edge of the right disk there was a grayish patch about $\frac{1}{3}$ disk diameter. Wassermann negative. The X-ray showed a definite right maxillary shadow, and the antrum condition was treated in the nose and throat division. The œdema of the eye grounds gradually cleared up, and the grayish patch was then recognized as a hole in the disk.

Dr. BRET RATNER reported (by invitation) a case of **Transitory Blindness** after **Chicken Pox** in a boy four and a half years of age, who, after chicken pox, developed complete blindness. Physical and laboratory tests were negative. B'indness persisted for eight days. Pupils were immobile during total blindness. Ophthalmoscopic examination showed presence of double optic neuritis. After the return of vision the neuritis in the right eye cleared entirely but the left eye still showed evidence of neuritis.

This case is the third one to appear in the literature, the other two being those of Chavernac and Paton. The author believes that blindness following an acute disease should be given a hopeful prognosis. A review of the literature includes a discussion of fleeting amaurosis in infancy, transitory blindness after varicella and influenza.

Dr. HARRY A. GOALWIN read (by invitation) a paper on **Roentgenography of the Orbit** and its clinical value. In the practice of ophthalmic Roentgenology one meets with two apparently different but fundamentally similar views on the part of the clinicians. There is on the one hand a group of ophthalmologists who expect little, if anything, from an X-ray examination, and, on the other hand, a group which expects too much. The former have failed to familiarize themselves with the possibilities of the X-ray demonstration of the anatomy and pathology of the orbit, the latter, with its

limitations. The orbit is one of the most complicated parts of the skull. Its X-ray study requires a special technique, as a brief review of its anatomy will show.

Technique: We attempt, whenever possible, to project the part to be investigated into the area enclosed by the projection of the orbital margin. In this way we eliminate interfering shadows. The complete X-ray examination requires at least seven different Roentgenograms. Of these, three serve for a general survey of the orbit. They are the lateral, axial and postero-anterior views. The roof and the floor require one view each, and the optic canal requires two views. The axial, postero-anterior, roof and floor Roentgenograms can be taken of both orbits simultaneously. The remaining views must be taken for each orbit separately.

Clinical considerations:

1. Anomalies of the bony orbit and of the optic canal.
2. Primary and metastatic tumors of the orbit and significance of vascular distribution.
3. Direct and indirect evidence of optic-nerve tumor.
4. Orbital periostitis and relation to sinusitis. Osteitis of zygoma.
5. Apparent and actual exophthalmos. The exophthalmos of skull deformities.
6. Fractures of the orbit and optic canal.
7. Relation of dacryocystitis to sinusitis.
8. The localization of ocular foreign bodies. A simple rule for determining whether the foreign body is in the eyeball or not.
9. Chronic sinusitis and eye operations.
10. The value of the various Roentgenograms in the conditions mentioned.

Lantern slide demonstration:

Three cases of fracture of the orbit.
Four cases of optic tumor.
One case of multiple osteomata of the orbit, around optic canal.
Fracture of the frontal sinus.
Fracture of the optic canal.

Osteitis of the zygoma after typhoid.
Complication of dacryocystitis with maxillary sinusitis (post-operative).
Infraorbital neuralgia.
Two cases of oxycephaly.
Two cases of plagiocephaly (oblique skull).
One case of traumatic plagiocephaly.
Some extra-orbital lesions in ophthalmic cases.
Tumor of the orbit.

Mr. BASIL GRAVES, of London, read (by invitation) a paper on **Some Suggested Clinical Slit-Lamp Investigations.** (To be published in full.)

DR. LEONARD KOEPPE read (by invitation) a paper on **Slit-Lamp Studies** and demonstrated his new slit-lamp. In the pursuit of slit-lamp studies of the normal living vitreous, we must take into consideration that we observe there an apparent and a true structure. I want to talk about the apparent structure of the vitreous seen from the optical standpoint of the slit-lamp.

With a narrow slit and very intensive focal illumination, you can orient yourself in the vitreous very exactly. First you see a more or less broad, dark zone, behind the lens, corresponding to the space of Berger, which is present in 90% of the cases.

We have known for many years that the vitreous is surrounded by the hyaloid membrane which is structureless. With the polarized light of the slit-lamp, we see that it is not a structureless membrane, as such a membrane causes a special color system in polarized light. In the living first layer of the vitreous, it is not possible to get this color by use of polarized light with the slit-lamp. Therefore we must give up the idea of a structureless membrane. We have a fine transparent microscopic network, in which we see the apparent structure visible in fine straight fibers or fibrils. By using a metallic mirror we can observe both a horizontal and a vertical structure in an irregular ribbonlike meshwork. The latter is apparently the result of irregular reflexion from a corrugation of the first layer. Therefore the first layer of the vitreous must be considered as a regular fine fibrous network functioning exactly like a structureless membrane.

In the first third of the normal vitreous you get a similar structure, only much finer. The horizontal structure appears more intensively than the vertical one, the whole presenting the image of a lattice square structure. This image will be seen in the first half of life as a rule.

From an optical standpoint, the vitreous of the young consists of many layers, like the layers of an onion, each lamella being made up of a cross structure showing a superposition of the structure of the deeper layers, causing further interesting optical interference phenomena to be observed in the lattice space structure of this interesting tissue. These interference phenomena consist of crossed or striped structures, produced in a similar manner to the crossed images in the well known Ives screen.

It is impossible to make an exact study of the vitreous after removing it from the eye as there are immediate changes veiling the true optical structure.

In the second stage of life, the living normal vitreous changes into a branching structure. In addition to the lattice space structure, sclerosis of the vitreous substance is visible as a diminished transparency of this tissue, and an increased corrugation of the single layers. Optical foldings of the layers are visible with interposition of slits. The different touching zones of the folded layers appear as enlarged ribbonlike structures of lattice-work, making the impression of branching of the ribbonlike formations in different directions. Finally the crossing points of the whole lattice structure are seen as a punctate condition in the living normal vitreous.

My new Universal slit-lamp may be used for microscopy of the living eye in natural, polarized or ultra-violet light; for fundus ophthalmology in red-free light; for ultra-violet treatment in tuberculosis and ultra-active alterations of the living cornea and iris; also for projection purposes. The principal points of this lamp (made by the Bausch and Lomb Optical Company, at Rochester, N. Y.) are as follows:

1. The rotation axis going through the eye is the same as the rotation axis of both the illumination and observation systems.

2. Illumination and observation systems can be moved easily in all directions.

3. If you have found a point in the living eye, you can move both illumination and observation together, in the same direction, in looking for parts of the tissue situated to the side of the first observed point.

4. The high intensity of the illumination is sufficient to do away with the arc lamp in the ordinary slit-lamp. A picture on the blackboard shows the method of getting 2.5 times more intensity of light than in the former instruments. In examining conjunctiva, episclera, scars, and cataracts the yellow filter may be used, as it better differentiates all kinds of pigment. For observing the conjunctival vessels the red-free filter is very successful.

The new Universal slit-lamp serves six different purposes:

1. You can make ordinary slit-lamp observations by use of natural, white or colored light.

2. You can use the new slit-lamp for observations made in polarized light.

3. Arc lamp with quartz lenses and with filter are provided for. Then you have some wave lengths from 310*mm* to 420*mm;* all beams short of 310*mm* are cut out. The used wave lengths mentioned above are not injurious. With these you can make a fluoroscopic examination of the living eye.

4. By using the same wave lengths you can use the slit-lamp for radiating treatment of recent corneal and iris tuberculosis; also for corneal ulceration, with ultra-violet light.

5. You can use the new lamp for fundus ophthalmology in red-free light.

6. Finally you can use the new instrument for projection purposes by putting slides before the illuminating lens and using a projection screen at 2–3 yards distance.

MEETING OF DECEMBER 21, 1925. DR. CONRAD BERENS, CHAIRMAN.

Dr. THOMAS H. CURTIN presented a man age 43 years with **Fibrosis of the Cornea.** There was a history of a foreign body nine months ago, followed three months later by a small white spot on the cornea. When first seen five months ago the area was 3*mm* in diameter, with a small black spot in the center. At the present time this black spot has disappeared, and the area of degeneration is 4*mm* in diameter. All tests were negative. X-ray for foreign body was negative.

DISCUSSION: Dr. DWYER thought this a case of fibrosis with fatty degeneration.

Dr. THOMAS H. CURTIN presented **six cases in one family of hereditary cataract.** These cases consist of the mother and five children, four males and one female. This is an Italian family with a negative family and personal history. The entire family was examined and given Wassermann tests which were negative.

The father's eyes are normal, and he does not wear glasses, although he is 51 years of age. There are ten children:

Males: M. G. age 28, eyes normal.
C. G. age 18, congenital cataracts, operated on when he was 11 at the Greenpoint Hospital, Brooklyn.
T. G. age 16, cataracts removed from both eyes when he was 11½, at the Greenpoint Hospital, Brooklyn.
J. G. age 14, cataract in the left eye removed by Dr. Curtin at the Bronx Eye and Ear Infirmary on February 14, 1924, right eye aphakic.
J. G. age 13, cataract in left eye, removed at the Bronx Eye and Ear Infirmary, August, 1925.
S. G. age 11, eyes normal.
D. G. age 8, eyes normal.

Females: L. G. age 23, both eyes operated on for cataract by Dr. Curtin.
J. G. age 20, eyes normal.
C. G. age 3, eyes normal.

The features in this series of cases are first: they do not seem to follow the Mendelian law; second: the appearance of cataract about the eleventh year. This would make it appear as though they were caused by some disturbance of metabolism, or dysfunction of some of the glands of internal secretions.

Dr. BEN WITT KEY read a paper on **Protein Therapy in Practice.**

He prefers diphtheria antitoxin to other non-specific proteins, and gives it in repeated doses of 1 to 6*cc.* This is used

in practically all infections of the eye. The results of a series of animal experiments were given, and two cases were reported.

Dr. ALAN C. WOODS, of Baltimore, read (by invitation) a paper on the **Use of Uveal Pigment in Sympathetic Ophthalmia.** Abstract in Report of Convention of English Speaking Ophthalmologists, London, July, 1925 (these ARCHIVES, January, 1926).

Dr. A. E. DAVIS read a paper on **Some Special Features in the Lens Protein Treatment of Cataract.**

Dr. Davis stated that after five years, experience in the use of Lens-Antigen he found that cataract with the subcapsular type of opacity was the only one affected by the treatment, and that improvement was proportionate to the age of the opacity; consequently he advises that every beginning presbyope be examined for the presence of lenticular changes, so that treatment may be begun when its results are greatest. The treatment is free from danger if administered with caution. Dr. Davis has seen no serious results from anaphylactic shock.

DISCUSSION: Dr. DWYER thinks—1. According to our knowledge of protein reactions these claims are absolutely contrary to what we know, and in fact, the opposite reaction should occur, for according to what we know about anaphylaxis, the injection of lens protein should produce cataract, and not prevent or cure it.

2. In his opinion, all such new work should be presented to and passed upon by some national body of ophthalmologists, before it is offered to the local society, or before such new lines of treatment are generally advised.

3. Dr. Dwyer thinks that Dr. Davis is to be congratulated upon his effort along new lines of investigation, although he cannot accept his views on this subject.

Dr. BECK said he first became acquainted with lens-antigen by sending one of his patients with cataracts to Dr. Davis, and that after a few months she was able to read ordinary print with her former lenses, an accomplishment which was utterly impossible before. Since that time he reported that he had sent eight cases to Dr. Davis, all of which had been arrested or improved. Since last summer he treated two cases himself by this method. In one there had been no change, in the other the vision had improved from $\frac{1}{10}$ to $\frac{1}{5}$. One of

the important features of this treatment was the improved mental attitude of the patient. He thought that all serious cases of infection should have the benefit of the methods described by Dr. Woods and Dr. Key.

Dr. BERENS said he was trying out Dr. Davis' method of treatment. There are other methods of attempting to arrest the development of cataracts, which should also be tried.

Dr. Davis in closing said that he could not explain why antigen causes absorption of the cataractous lens, and why it does not cause cloudiness of the normal lens.

PROCEEDINGS OF THE SECTION OF OPHTHALMOLOGY, B. M. A., AT THE ANNUAL MEETING AT BATH, JULY, 1925.

Discussion on Eye Injuries and Interstitial Keratitis.

By Dr. P. G. DOYNE, London.

Dr. Holmes Spicer in opening the discussion said that in a certain number of cases of interstitial keratitis there seemed to be a close association between injury and the onset of the disease. This was an important matter from the medico-legal aspect. The injury is often quite trivial, such as a foreign body on the cornea. In 3% of these cases there was a direct association with injury. Harrison Butler in his series finds this association in 20% of his cases in every deviation from the normal, and in addition, if every injury to a remote part of the body is considered, then the percentage association will be enormously raised. If injury is the direct cause of interstitial keratitis, it is not possible to give a satisfactory explanation of the appearance of interstitial keratitis in the second eye.

Holmes Spicer quotes a case of a person showing the stigmata of congenital syphilis, well marked, who had three needlings, one curette evacuation and an iridectomy upon his eye. These eyes remained quiet for four years after the last operation, and then severe interstitial keratitis occurred. The inevitable conclusion was that at the time of the operations the spirocheta had not reached the required stage of evolution which it eventually did reach four years later. This appears to be true of many of the congenital syphilitic lesions in the body. There is the period of iritis in infants, of choroiditis, of meningeal attacks, and so on.

Holmes Spicer would allow this much to injury, that it may be the final immediate exciting cause inasmuch as it is possible that the spirochete having reached its required stage of evolution may need some final stimulus to start its actual activity in the cornea. He says that if injury were in every case a coincidence, and had no part in the attack, then cases should be found in which injury to an eye was followed by interstitial keratitis in the other. He has no doubt that this has occurred but he has no record of its occurrence in his own series of cases.

Dr. INGLIS POLLOCK discussed the symptoms, diagnosis and treatment of interstitial keratitis. He thought that tuberculous interstitial keratitis may simulate the syphilitic in all respects, and be extremely difficult to diagnose. He thought that modern methods of treatment, especially the intravenous use of the arsenical compound, had improved the end results of the disease enormously.

With regard to injury, the two cases, so associated in his series, began as simple traumatic corneal ulcers. These responded to treatment at first, but after a few days became worse and turned into interstitial keratitis.

Dr. FREELAND FERGUS said that after examining a number of blind persons, he found that a large proportion of these cases owed their blindness to the failure of a cataract operation. In a number of these cases he found a positive Wassermann reaction. He thought that trauma of the operation, plus the presence of syphilis, might account for the disaster.

Dr. BISHOP HARMAN said that everyone would agree that injury would not give rise to the condition unless the spirochete was present. But from the medico-legal viewpoint, the issue was—would the attack have occurred at the time it did, trauma or no trauma. He did not think there was enough evidence, but it was needed before they could say that the eye manifestation was inevitable at a given date. He doubted if the history of injury was always justified. In the early stages of ocular inflammation, there was continually a feeling of "something in the eye."

Dr. CYRIL WALKER thought that interstitial keratitis was of much less frequency nowadays than formerly. He had seen

two cases definitely following trauma, and they were cases which followed a severe conjunctivitis. In these two cases the interstitial keratitis, which was clinically typical, affected only the injured eye. He had never seen interstitial keratitis in an eye as the result of injury to the fellow eye.

Dr. PRIMROSE said that he had examined the histories of those cases of interstitial keratitis which gave a history of trauma, with care. He had known a case in which the condition started in the uninjured eye. If it was due to coincidence then one would expect the inflammation to occur as often in the uninjured as in the injured eye.

Dr. WALLACE HENRY referred to a case of interstitial keratitis occurring in both eyes within ten days of an injury to one eye.

Dr. DE SCHWEINITZ thought that even a slight injury to the cornea might assist an attack of the spirocheta pallida on this susceptible tissue, by lowering its resistance, but without the injury, the disease was practically certain to occur sooner or later. The condition seemed analogous to the effect of the injury on a tissue which would then fail to resist a bacterial attack from an area of local sepsis.

Dr. R. KERRY except for infected superficial lesions of the eye thought that all inflammations of the eye must be considered as secondary.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By Mr. H. DICKINSON, London.

A clinical meeting of the Section took place at St. Thomas' Hospital on Friday afternoon, December 11th, 1925, under the presidency of Sir Arnold Lawson.

Metastatic Inflammatory Deposit in Cloquet's Canal.

Mr. Malcolm Hepburn showed a woman aged 33 who had this condition in both eyes. In April, 1923, she came to hospital complaining of misty sight in both eyes following a poisoned foot and pyorrhœa. No view of the fundus of either eye could be obtained, but a white hazy mass occupied the central part of the vitreous, and seemed to be connected with the disk behind. On this day of the meeting the fundus could be seen clearly at the periphery, for the first time, but the centre was still occupied by a white mass of organized exudate. Her vision remained much the same. If this had been hemorrhage, Mr. Hepburn thought it would have moved ere this, and there would have been a quicker clearing up. He feared there would be a shrinking of the vitreous, and he asked the views of members as to prognosis.

The President said he formed the opinion that it was probably a septic condition.

Cases of Central Retinitis.

Mr. A. C. Hudson showed two cases of this condition, in patients aged respectively 41 and 43. The first, a post office

sorter, had had severe pain at the back of the right eye since 1918 in attacks lasting about 45 minutes, also pain in the temples. All his teeth were removed for pyorrhœa in 1920 and 1921. No history of nose or throat disease, nor of venereal disease. There was apparently a calcification of the retina in the macular region and some disturbance of retinal pigment, also there were a number of minute bright dots scattered over the foveal region. Mostly this condition was unilateral, but at least one case he had seen was bilateral. There might be a generalized thickening of Bruch's membrane. In many of these cases the vision was not seriously affected. Some of the cases, however, complained not only of defective vision but of seeing through a violet haze, one said he seemed to be looking through a green veil. These were very difficult cases to treat with confidence; several had been in the hands of throat surgeons, who gave the patients iodide of potassium by the mouth. The sight seemed to remain much the same after weeks, or even months, of treatment.

White Mass in the Macular Region.

Mr. HUDSON showed a girl, aged 11 years, who had a white mass in the macular region, and two other white masses in the periphery of the fundus below. He thought it was due to an external hemorrhagic retinitis, the condition Coats described and collected cases of. During the two years he had been seeing the patient the condition had not altered in appearance. The child had never had whooping cough, and Mr. Hudson could not find anything to connect causally with the condition.

Mr. GRAY CLEGG regarded it as a form of Coats' disease.

THE PRESIDENT said that hemorrhages in the retina were not very uncommon in children. In one case of bad retinal hemorrhage he had, in a boy aged 15, the cause was evidently masturbation, and when that was checked the hemorrhages disappeared, and acute vision returned.

Band-Shaped Opacity of Cornea.

Mr. HUDSON showed a patient with this condition. In each case of this condition he had had he scraped away the

opacity, and there was very little reaction, and convalescence was satisfactory, healing taking place in about a week. Vision in this case improved from $\frac{6}{18}$ before the operation to $\frac{6}{6}$.

Ichthyosis of Skin, with Ectropion.

Mr. HUDSON's next case was one of severe congenital ichthyosis of the skin with ectropion. The left eye had extensive chronic keratitis in a very irritable state, and it looked as if it would extend and cause the loss of the eye, the other having already been completely destroyed. Tarsorraphy seemed to be out of the question; there was so much tension on the skin that it did not seem likely that union would take place. It seemed a suitable case for a Thiersch graft, if a suitable site could be chosen from which to take the skin. He chose the outer surface of the patient's arm, but the skin, instead of being supple, had a parchment-like consistency. However, when it was removed, a bleeding surface was left, therefore it was clear that the graft contained living cells. The graft took very well; it had now shrunk somewhat, but the condition was now much better than before the operation, and the eye was satisfactorily closed when the man was asleep. He did not think a graft taken from some other person would have taken.

Two Cases of Black Cataract.

Mr. HUDSON next showed two cases of black cataract. When seen, the pupils of one of the patients were widely dilated and obviously she was very blind. With the light from the window he saw a pearly-grey reflex coming from behind the lens. The patient said that twenty years ago she had a severe blow on the right eye, and lost the sight of it two years afterwards. In the left eye there was not only an active pupil, but also good projection of light, and the ophthalmoscope showed a pearly reflex, like that of detached retina. He therefore extracted the cataract. There was an enormous lens, almost the color of a prune. She did very well afterwards, and in spite of having had choroido-retinal degeneration, probably as a result of myopia, she now had $\frac{6}{18}$ vision without glasses. The other case of this condition, in a man, had no fundus disease at all.

Mr. GRAY GLEGG spoke of a similar case he had recently, in which he removed the lens, and of the sheen he saw. He agreed that such cataracts might occur in healthy eyes.

THE PRESIDENT agreed with Mr. Clegg's last remark.

Neurofibromatosis with Buphthalmos and Keratectasia.

Mr. HUDSON showed a man with this combination, the neurofibromatosis affecting the fifth nerve. He thought the injection and irritability of the eye needed that it should be excised.

Case of Cyst of the Iris.

Mr. P. G. DOYNE showed a woman, aged 46, who attended hospital and asked for an operation. On dilating the eye, a dark cystic condition became apparent on the lower and outer third of the iris, forming a chord of the arc of the pupil in that region. It seemed to be a cyst of the retinal portion of the iris, and was more or less translucent. Tension was normal.

Mr. GRAY GLEGG said there was an exactly similar case in his hospital, still under observation, and in many months there was no sign of change. It was a question whether at this stage operative interference ought to be undertaken. Cysts of the iris were not very satisfactory to deal with.

Mr. T. HARRISON BUTLER suggested that the appearance was more like that of foreign body than cyst; the straight line taken by this condition did not suggest cyst to him.

Mr. DOYNE replied that the border was rounded, and it had a translucent look. It was transilluminable at the limbus.

Double Leucoma Adherens.

Mr. HUDSON demonstrated for his colleague Mr. K. G. W. SAUNDERS a case of double leucoma adherens. It was shown as a curiosity, and Mr. Hudson said he thought it was unique. Contrary to expectation, the eye showed no increase of tension.

The meeting passed a cordial vote of thanks to Mr. Hudson and Mr. Doyne for having provided such an instructive series of cases.

SECTIONS OF OPHTHALMOLOGY AND LARYNGOLOGY.

On Jan. 8th these Sections combined for the purpose of discussing the subject of **Optic Neuritis in its Relation to Sinusitis.** The chair was occupied by the president of the Section of Ophthalmology, Sir ARNOLD LAWSON, K.B.E.

Clinical Case.

Before the discussion Mr. Affleck Greeves showed a middle-aged woman whose retrobulbar neuritis of 6 months' duration was cured after the sphenoidal, and especially after the ethmoid cells had been explored and evacuated. The culture gave practically pure influenza bacillus. Sir St. Clair Thomson, President of the Society, who did the exploration, confirmed the clinical details.

Dr. A. LOGAN TURNER, P.R.C.S., Ed., in opening the debate, said that at a conjoint meeting of the Scottish Society of Otology and Laryngology and the Scottish Ophthalmological Club, in March, 1924, the subject of visual disturbance in relation to affections of the nasal cavities and posterior sinuses was discussed. It eventuated in the appointment of a committee to examine a series of cases of retrobulbar neuritis and submit a report on them in two years. He was able, through the courtesy of his colleagues, to give a kind of interim report on this work, dealing only with the rhinological part, basing his remarks on a summary of 28 cases studied by the Edinburgh group. Cases in which the diagnosis was doubtful and instances of syphilis, Leber's atrophy, tumor, and tobacco amblyopia were excluded. All the cases in the series belonged to the retrobulbar type of optic neuritis, in which the vision, usually of one eye, was fairly rapidly impaired, but showed a tendency to spontaneously recover and this was the end-result in most of the cases examined. On the rhinological side the cases had two striking features: the almost entire absence of subjective nasal symptoms, and a complete absence of those signs which the rhinologist regarded as evidence of suppurative sinus disease.

For the purposes of discussion, he grouped the cases as follows:

In group A, 3 (possibly 4) cases were regarded by the neurologist as disseminated sclerosis. In this group the vision had returned almost to normal when the patients were last examined, *i.e.*, to $\frac{6}{9}$ in three, to $\frac{6}{18}$ in one.

Group B. In 5 in this class resection of the nasal septum was advised to relieve the crowding in the middle turbinal and olfactory region. In 2 this was performed, the 3 other patients declining it. In all 5 the vision returned to approximately normal.

In group C were 6 cases in which the posterior sinuses were opened. One of them belonged to group A, as it had disseminated sclerosis. In 3 of the operated cases the sinuses were healthy, as microscopically proved. The vision in 2 of these normal cases was unaltered by treatment, there being in both a high degree of defect. In the third, though the sinus explored was normal, vision improved from fingers at one meter to $\frac{6}{36}$. In one case there was slight catarrhal change in the sphenoidal sinus mucous membrane, but no infiltration by inflammatory cells; vision here improved from $\frac{6}{18}$ to $\frac{6}{9}$. In the other operation cases no disease of sinuses was detected, and vision afterwards improved from hand movements to $\frac{6}{36}$ and $\frac{6}{9}$ respectively.

Group D, three cases of septic teeth, which were extracted, and thereafter vision in two improved to $\frac{6}{9}$ and $\frac{6}{18}$ (that of the third was not ascertained).

In the last group, E, were 10 cases in which no nasal interference was carried out. In 4, the vision improved to $\frac{6}{9}$, in one to $\frac{6}{9}$, in two to $\frac{6}{12}$, in one to $\frac{6}{18}$ when last tested.

Summarizing, he said that in none of the 25 cases was there any clinical evidence of suppurative sinus disease, and in the 6 cases in which the posterior sinuses were opened, no pus or secretion was found. Of the 6 cases in which the posterior sinuses were opened, they were found to be healthy in 3. Of the remainder, the lining membrane in one showed slight catarrhal changes, and in the other two there was naked-eye evidence of congestion of the mucosa. A septal operation was performed in two of the 12 cases of narrowing or crowding of the olfactory and middle turbinal area; yet the vision returned to normal, or nearly normal, in all the cases. Nasal-sinus disease as an ætiological factor played but a very incon-

spicuous part in the cases in the series. In 3 cases septic teeth were a possible causative factor. After they had been extracted vision became normal, or nearly so. In estimating the beneficial effect on the vision of surgical interference in nasal or posterior sinus cavities, regard must be had to the fact that in retrobulbar neuritis there was a tendency towards spontaneous cure, and operation might be performed at a time when the vision was naturally tending towards restoration. A further collective investigation was needed.

Mr. M. S. MAYOU said the forms of optic neuritis which were associated with nasal disease fell into two main groups having very different clinical and pathological characteristics. There was, first, papillœdema or swelling of the nerve head due to distension of the optic nerve sheath with fluid, causing venous obstruction by pressure on the central retinal vein at its entrance into the globe. This gave rise, chiefly, to a slow steady failure of vision, with very marked swelling of the nerve head; intense congestion of the retinal veins, often with hemorrhages and white patches of exudation into the retina known in the advanced stage as "choked disk." Secondly, there was retrobulbar or interstitial neuritis, in which there was an inflammatory patch or patches of exudation into the trabecula of the optic nerve, causing direct pressure on the nerve fibers and interference with their function, in some cases bringing about their complete destruction. The only cause of this disease of which there was positive evidence was disseminated sclerosis, in which there were patches of inflammatory degenerative process in the nerve, though similar patches might occur from embolic infection through the blood stream from a septic focus elsewhere in the body, such as a suppurating nasal sinus. The principal signs of the disease were a rapid loss of central vision, the characteristic pupil reaction to light in which, after a maximum contraction of the pupil, it dilated with marked hippus, and a tenderness on movement or pressure on the globe. There was also a central scotoma for white and color, and sometimes limitations of portions of the peripheral field. Papillœdema might occur as the result of a subacute meningitis following a suppurating sphenoid sinus opening beneath the dura, or a spreading necrosis of the cranial bones as the result of operation on or

disease in the bones of the nose, and, in rare instances, it might be the result of thrombosis of the cavernous sinus. Papillœdema in the case of subdural rupture of the sphenoidal sinus might be present for a very long time before the cause was discovered. He had had a considerable number of cases of retrobulbar neuritis examined by rhinologists, but they had never yet found one in which the sphenoidal sinus was infected. But he had had three cases where the antrum was full of pus, and one in which the ethmoid sinus was infected. After clearing out the antrum and ethmoid all the cases made a satisfactory recovery.

Mr. E. D. D. Davis said he had studied the notes of 76 cases of retrobulbar neuritis which had been referred to him to make an examination of the nose in order to determine the cause of the eye condition. Those patients were kept under observation for long periods and were followed up. In 30 the cause for the optic condition was not discovered, but nasal disease could be excluded. Disseminated sclerosis was present in 14, syphilis in 9, septic teeth in 7, and in only 7 was there manifest sinus suppuration. He discussed the relationship of the sphenoid and posterior ethmoidal cells to the optic nerve, remarking that optic neuritis arising from inflammation of the nasal sinuses could be produced in the following ways: direct extension by continuity of structure, thrombosis of venous vessels or sinuses, acute nasal catarrh, toxæmia or bacteræmia. Of the cases in which there was nasal sinus suppuration, operation in three produced a dramatically rapid improvement in the patient's vision; optic atrophy in the other two prevented such a result. Suppuration of the antrum originating in the nose was, practically always, associated with involvement also of the frontal and ethmoidal cells. However, when the antral suppuration was due to diseased teeth, the antrum only was implicated. In the very numerous dental cases which his work enabled him to see, retrobulbar neuritis had never been recorded. He did not find that a careful study of charts of the fields of vision presented by nasal cases provided any aid to diagnosis. Optic neuritis arising from septic venous thrombosis was rare, and in those cases the acuteness of the illness was such as to place in a subsidiary category any symptoms of amblyopia. Neither had he

seen retrobulbar neuritis occurring in the course of an acute nasal catarrh. If a patient had an increasing retrobulbar neuritis for which no other cause could be discovered and there was reason to suspect sinus disease, he considered it justifiable to remove the middle turbinal and explore the ethmoidal and sphenoidal cells; in skilful hands the operative risk attending this was practically negligible.

Mr. R. FOSTER MOORE, O.B.E., confined his remarks practically to cases of retrobulbar neuritis, and said several among Mr. Edward Davis' cases did not properly belong to this category. The characteristics of the disease, as generally understood, were a rapid loss of central vision, some pain on movement of or pressure on the globe, an optic disk differing but little from the normal in appearance; a pupil which contracted to light but could not maintain that contraction, and a marked tendency for the condition to recover. Commonly it was unilateral, and occurred mostly between 20 and 40 years of age. Some surgeons attributed an important rôle to infection of paranasal sinuses in the causation of retrobulbar neuritis, but in his experience this was one of the rarest of the causes. To facilitate investigation, he admitted all such cases as in-patients, where they were overhauled by various specialists. Some observers appeared to believe that a latent sinus infection might often be the cause of the condition, perhaps because many cases got well after the sinuses had been opened. He felt that such a view needed very critical consideration before it was accepted; he felt that very few such cases would not have got well if nothing operative had been done. Among the cases in Mr. Davis' list were 14 of disseminated sclerosis, and probably in the course of years a considerable proportion of the 30 doubtful cases would be subjects of that disease. In many cases of that disease retrobulbar neuritis was the first and, at the time, the only discoverable sign of the condition, and it might be years before any further manifestation took place. Undoubtedly the optic nerve might be seriously involved by a suppurative process extending to it from any of the surrounding structures, and Mr. Davis had shown that in those cases the inflammation was severe and destructive, and in some of those cases blindness had resulted from thrombosis in the vessels in the orbit. In conclusion he declared that

apart from the spread of a suppurative process from surrounding structures which had caused an orbital abscess or thrombosis of the vessels—which few clinicians would include as retrobulbar neuritis—he had never seen a case of the latter which he regarded as due to paranasal disease. Six of his colleagues held the same view.

Sir St. Clair Thomson said he had had but few of these cases, but a typical one was that of the lady shown today. She had had no symptoms pointing to sinus disease, but when he had opened the sphenoid she improved somewhat. Later he opened the posterior ethmoidal cells, where there was cystic degeneration, and following that she became quite well. Of two others, one got well after operation on sinuses, but the eye of the other patient still remained blind in spite of sinus evacuation.

Mr. E. Treacher Collins said the case shown today was not true retrobulbar neuritis, but there was marked papillitis; and there could be no doubt about the improvement subsequent to the sinus operations, in vision, subsidence of the swelling and of the retinal exudation. He had not yet seen a case in which a retrobulbar neuritis could be attributed to sinus disease.

Mr. F. A. Williamson-Noble said that all cases of retrobulbar neuritis had an optic foramen which was smaller than the normal, and this, he said, suggested that one explanation of the condition might be the exertion of pressure on the nerve. In some intractable cases it might be possible to reach the foramen sub-periosteally, and enlarge it.

Dr. P. Watson-Williams said that a considerable number of cases of the kind now discussed proceeded to optic atrophy, and everything possible should be done to save the patient from that very serious sequel. Before operation was undertaken each patient should be given a thorough ophthalmological examination. The cases which had toxic symptoms seemed to be largely those which showed no marked evidence of suppuration.

Dr. J. A. Gibb referred to five cases in his experience in which in coincident retrobulbar neuritis the ethmoidal cells were infected, and in those cases, he said, recovery of the eye followed operation on the cells of the sinus concerned.

Mr. D. LEIGHTON DAVIES spoke of his own experience, and said he found that optic nerve changes in cases of nasal sinus disease were relatively uncommon.

Mr. H. M. TRAQUAIR (Edinburgh) said he had never seen a case of retrobulbar neuritis which could be traced to nasal sinus disease, except in cases in which the nasal sinus was obviously, or grossly infected. It was necessary to dissociate pressure conditions from inflammatory conditions. He and his colleagues had found that cases of optic atrophy due to retrobulbar neuritis were quite uncommon. When the disease was bilateral there was a greater tendency to recovery than when unilateral; especially was this so in elderly patients. When the appearance of the disk was normal, the central vision good, and there was no orientation difficulty, great caution should be used in ascribing these to organic disease of the optic nerve.

Dr. JOBSON HORNE pointed out that nasal conditions and ocular conditions, when existing in the same patient, might be independent of each other. In a few cases, blindness had followed treatment of sphenoidal sinus disease. He agreed with Dr. Logan Turner's and Mr. Foster Moore's conclusions on the subject.

Mr. GRAY CLEGG (Manchester) said that in no case had he felt that a retrobulbar neuritis had been due to disease of the posterior ethmoid cells or the sphenoid sinus.

Mr. A. L. WHITEHEAD (Leeds) remarked that in only two of his cases of optic neuritis and papillœdema with retinal changes could any connection be established with sinus suppuration, and in them the disease was of a gross degree. In them, opening up of the cells was followed by some improved vision, but this was limited by atrophy in the retina. Some of the cases narrated in this discussion might, he thought, be equally explained by a blood or lymph infection.

PHACOANAPHYLACTIC ENDOPHTHALMITIS.

By Dr. F. H. VERHOEFF, Boston, Mass.

243 Charles St.,
Boston, Mass.,
March 22, 1926.

To the Editor:

In the March issue of the Archives there appears a communication by Rötth in which he claims to have demonstrated that phacoanaphylactic endophthalmitis has no existence. He gives no protocols of the animal experiments in which he traumatized the lenses of sensitized guinea pigs, does not state that any of the eyes were examined microscopically, and does not even mention the number of the experiments. It is therefore impossible for the reader to form an opinion as to the significance of these experiments. He implies that the reactions were severe in both the sensitized and control animals and states that infection occurred in several. This is not surprising since a large piece of the lens capsule was removed with forceps and an incision of considerable size must therefore have been made in the cornea. I have found that a guinea pig's lens is easily infected even during such a simple operation as discission. For this reason, Lemoine and I did not in any way base our conclusions regarding the occurrence of phacoanaphylactic endophthalmitis in human subjects upon our animal experiments. I called especial attention to this fact in the discussion of our paper at the International Ophthalmological Congress in Washington. We pointed out that the condition of allergy toward lens protein in human subjects may be different from the anaphylactic condition artificially produced in animals. One important difference is that the latter condition is transient, while the former seems to be

permanent. The results of animal experiments if positive would, of course, afford corroborative evidence as to the existence of phacoanaphylactic endophthalmitis in human subjects, but if negative they would be of little importance.

Our conclusions were based chiefly upon the observations: (a) that about 8% of cataract patients were hypersensitive to lens protein as determined by intradermal tests, (b) that in a series of 12 cases with severe intraocular reaction following injury to the lens, each patient was hypersensitive to lens protein, and (c) that the eyes removed in five of these cases showed what we believed to be a characteristic histological picture. Rötth has not repeated and does not comment upon our observations (b) and (c), but states that he failed to confirm our observations (a). Following our technique he tested 106 patients and obtained a negative result in each. This is truly surprising in view of the fact that Lemoine and McDonald obtained about 8% of positive reactions in a series of 168 unselected cases. Moreover, I subsequently obtained the same percentage in a series of fifty unselected cases that I tested with pig lens protein supplied by Parke Davis & Co. for experimental purposes. Rötth's negative results raise the question as to whether or not hypersensitiveness to lens protein may not be less frequent or less marked in certain races. He does not mention the ages of his patients; possibly he did not include many old individuals. He states that when he employed a dose of .1–.2 *ccm* he obtained positive skin reactions in 10 out of 48 cases. If these reactions were entirely non-specific as he claims, why did not the remaining 38 cases also show skin reactions? He also states that in two of the ten cases cataract extraction was performed without any resulting ocular reaction. He fails to mention, however, whether or not these were cases of mature cataract or how much lens matter was left in the eyes.

Rötth contends that if 8% of patients are hypersensitive to lens protein, then in 8% of all cataract cases in which extraction is performed ocular reactions should occur. This reasoning is obviously fallacious, for in the majority of cataract cases an insufficient amount of lens matter is left in the eye to cause a definite ocular reaction in a hypersensitive patient. Moreover, our observations indicated that cataractous lens

matter was less effective than clear lens matter. In an ordinary series of cataract cases, therefore, in only a few cases, and these chiefly of immature cataract, could serious phacoanaphylactic endophthalmitis be expected to occur. For this reason we advocated making intradermal tests before operation only in cases of immature cataract.

Rötth maintains that because he was unable to sensitize guinea pigs to their own lens protein, it is impossible for any human individuals to be hypersensitive to their lens protein. Assuming that his experiments are conclusive, in my opinion an extremely doubtful assumption, this deduction is still not justifiable. For it is not necessary to assume that human individuals become hypersensitive through exposure to human lens protein or to any other lens protein. Certainly Lemoine and I made no such assumption. Just how certain individuals have become hypersensitive to certain proteins is entirely unknown. In many cases the hypersensitiveness seems to be hereditary.

From the foregoing considerations I conclude that the negative evidence presented by Rötth as to the existence of endophthalmitis phacoanaphylactica is entirely unconvincing.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY.

Abstracts by Drs. A. N. Alling, New Haven; P. G. Doyne, London; and K. Wessely (*Archiv für Augenheilkunde*), Würzburg.

Edited by Matthias Lanckton Foster, M.D., F.A.C.S., New Rochelle, N. Y.

(*Continued from March issue.*)

X.—AQUEOUS. LENS. VITREOUS.

226. Beauvieux and Germain. **De la cataracte polaire anterieure.** *Archiv d'Ophtalmologie*, 1922, xxxix, No. 5.

227. Bedell, Arthur J. **Study of the vitreous.** *New York State Journal of Medicine*, June, 1924.

228. Braum. **Results with replacement of the vitreous.** *Archiv f. Ophtalmologie*, cx, p. 59.

229. Clapp, C. A. **Liquefaction and absorption of the crystalline lens with its possible relation to lenticular opacities.** *American Journal of Ophthalmology*, February, 1924.

230. Davis, A. E. **Lens antigen (vaccines) used to absorb cortical matter after the extraction of cataract.** *Ibid.*, April, 1923.

231. Derby, G. S. **Modern aids to cataract extraction.** *Journal A. M. A.*, December 22, 1923.

232. Elschnig, A. **Extraction of senile cataract in capsule.** *German Ophthalmological Society*, Jena, June, 1922.

233. Frese. **Slit-lamp picture of electric cataract, with experimental studies in rabbits.** *Archiv f. Augenheilkunde*, xci, 1922.

234. Friede, R. **New method of subconjunctival extraction of cataract.** *Archiv f. Ophtalmologie*, cviii, 1922, Nos. 3–4.

235. Gifford, S. R. and Latta, J. S. **Pseudoglioma and remains of the tunica vasculosa lentis.** *American Journal of Ophthalmology*, July, 1923.

236. Gjessing. **A case of cataracta electrica examined with Gullstrand's slit-lamp.** *British Journal of Ophthalmology*, 1922, No. 10.

237. Hektoen, L. **Immune reactions of the lens.** *American Journal of Ophthalmology*, April, 1923.

238. KRAUPA, E. **Ruptures of the lens capsule without traumatic cataract.** *Zeitschrift f. Augenheilkunde*, xlix, 1922, Nos. 2 and 3.

239. KRESS, G. H. **Cysticercus of the vitreous with case report.** *American Journal of Ophthalmology*, March, 1924.

240. V. KRUEDENER. **Subconjunctival extraction of cataract.** *German Ophthalmological Society*, Jena, June, 1922.

241. LINDBURG, J. G. **Initial stages of naphthalin cataract in the rabbit's eye. Does the iris play a part in the spread of the cataract in the anterior cortex of the lens?** *Klin. Monatsbl. f. Augenh.*, lxviii, 1922.

242. MARQUEZ. **Double cataract removed from one eye.** *Ibid.*, lxviii, 1922.

243. MEESMANN. **Behavior of the zonule in luxation of the lens.** *Deutsche ophthalm. Gesellsch.*, Jena, June, 1922.

244. MEESMANN. **The picture of subluxation and ectopia of the lens with the slit-lamp, together with remarks concerning the zonule.** *Archiv f. Augenheilkunde*, xci, 1922.

245. PETER, L. C. **Slit-lamp studies of hernia of the vitreous. Its relations to cataract operations.** *American Journal of Ophthalm.*, August, 1923.

246. ROCHE. **Luxation bilaterale du cristallin dans la chambre anterieure.** *Archives d'Ophtalmologie*, 1921, No. 9, p. 563.

247. ROLLET AND BUSSY. **La cataracte noire.** *Ibid.*, 1922, No. 2, p. 65.

248. SEEFELDER. **Origin of congenital cataract.** *Archiv f. Ophthalmol.*, cviii, 1922, Nos. 3 and 4.

249. THOMPSON, E. **A clinical account of a series of cases of capsular (capsulosubcapsular) cataract associated with the deposit of pigment at or around the centre of the capsule, with considerations as to the ætiology.** *British Journal of Ophthalmology*, June, 1922.

250. VON DER HEYDT, R. **The visibility of corpuscular elements within the aqueous.** *American Journal of Ophthalmology*, October, 1923.

251. ZENTMAYER, W. **Intracapsular cataract extraction with the erisiphake.** *Ibid.*, March, 1923.

252. ZENTMAYER, WILLIAM. **The pathogenesis of Vossius ring cataract.** *Ibid.*, September, 1924.

VON DER HEYDT (250, **Visibility of corpuscular elements within the aqueous**) has demonstrated by means of the slit-lamp that a postlental space exists filled with a fluid similar to the aqueous. The remnant of the hyaloid artery is usually seen to move freely in this space. Although stray leucocytes may occasionally be seen in the aqueous it is normally an empty fluid. Under pathological conditions the leucocytes, pigment cells, granules are plainly visible, and their movements show that there is a continuous flow of aqueous upwards

over the warmer iris and downwards anteriorly near the cornea. In cases of iridocyclitis, as the process advances, the aqueous become more viscid and the movements of the cells become slower. ALLING.

BEAUVIEUX AND GERMAIN (226, **Anterior polar cataract**) examined an eye enucleated from a man 73 years old because of secondary glaucoma, leucoma adherens, staphyloma of the cornea, and hypopyon keratitis. At the level of the scar in the cornea there was a slight conical protrusion of the anterior capsule of the lens without any injury. The epithelium of the capsule and the cortical lenticular fibres at this place showed degenerative changes. The protruding portion was filled with an exudate, *i.e.*, the cells here formed no connected layer, had in part completely disappeared, and presented swollen nuclei and hyaline degeneration of the protoplasm. The fibers at the anterior pole of the lens were degenerated likewise, but to a less degree. The authors think this to be not a case of capsular cataract, but a cataract of the anterior pole of the lens, as the lesion involves the cortical lens fibers and the epithelium. The opinion is advanced that the sudden blow of the lens against the perforated cornea was a factor which favored the entrance of toxines.

CLAPP (229, **Liquefaction and absorption of the crystalline lens with its possible relation to lenticular opacities**) is inclined to think that the aqueous has a proteolytic ferment which is capable of breaking up all the lens albuminoids into simpler compounds and further that there is a definite autolytic action in the lens itself. In Morgagnian cataract there is a rupturing of the fiber membrane and a selfdigestion. Senile cataract he explains on the theory that variations in the concentration and chemical compositions of the lens fluids produce osmotic pressure and ruptures the fiber membrane thus leading to precipitation of the insoluable albuminoids. ALLING.

DAVIS (230, **Lens antigen (vaccines) used to absorb cortical matter after the extraction of cataract**) is using lens antigen injections in all cases of traumatic cataract where the sensitization test does not show a hypersensitiveness to lens antigen. He relates a case in which while under this treatment the lens matter surrounded by the capsule was completely

absorbed and a soft eye resulting from severe inflammation was brought to normal tension and good vision. ALLING.

HEKTOEN (237, **Immune reactions of the lens**) has studied the action of antilens rabbit serum on the lens and other tissues of various animals. It was produced by injection of rabbits with beef, sheep, horse and human lens. The sum of the observations is that in the precipitin test the lens is organ-specific and not species-specific. It is the one tissue of the eye that as a rule does not contain any species-specific elements, that is, elements that react with antiserum produced by injection of human serum in rabbits. ALLING.

DERBY (231, **Modern aids to cataract extraction**) advocates paralysis of the orbicularis by injecting through the upper and lower lids with 2 *cc* of 2 per cent. procain. In inflamed eyes complete local anæsthesia is obtained by instilling also one or two drops of 10 per cent. solution of cocain in addition to the ordinary 2 per cent. In unruly cases 1 or 2 *cc* of a 2 per cent. solution of procain and epinephrin is injected toward the center of the orbit. He thinks that the best protection against prolapse of the iris is the conjunctival suture according to the method described by Verhoeff. ALLING.

ELSCHNIG (232, **Extraction of senile cataract in capsule**) expresses the opinion, based on his experience, that iridectomy is indicated prior to the performance of Smith's operation as a rule, and that simple extraction in that manner is unsuited to all forms of cataract except the Morgagnian.

FRIEDE (234, **New method of subconjunctival extraction of cataract**) after anæsthetization of the parts with novocain and adrenalin performs a cantholysis at the outer canthus, a canthotomy with division of the palpebral ligament. From this point he undermines the conjunctiva of the lower half of the eyeball from he margin of the cornea to the lower fornix and the inner canthus. The lower lid is then split by an intermarginal incision, the lower fornix dissected clear and the freed conjunctiva laid back so as to expose the field of operation. The cornea is incised and the lens extracted downwards. The pupil has been dilated previously, but a peripheral iridectomy or an incision of the root of the iris may be necessary. An ordinary iridectomy is not advisable. Toilet of the wound; suture of the lid if necessary. Dressing

changed next day, on which the patient can leave his bed and go about as the broad adhering surfaces of the conjunctiva protect the wound. The advantage claimed is protection of the wound from infection. Deformity of the lower lid followed in one case, but this can be avoided, according to the author, by a careful technique.

VON KRUEDENER (240, **Subconjunctival extraction of cataract**) considers Czermak's subconjunctival extraction too complicated. He obtains a covering, even though not so perfect as Czermak's, by making a broad flap with the Graefe knife after the section of the cornea which secures a very quick closure of the wound and prevents a prolapse of iris.

MARQUES (242, **Double cataract removed from one eye**) reports the case of a patient 57 years old from whom he removed a black cataract. A mass remained which had to be removed later and proved to be a second cataract. There were two plano-convex lenses present.

Ten cases operated upon by Barraquer are reported by ZENTMAYER (251, **Intracapsular cataract extraction with the erisiphake**). There was no loss of vitreous nor iris prolapse. In two cases there was severe reaction with occlusion of the pupil in one and three failures to deliver in the capsule. He thinks that the combined extraction gives in the end, results which compare favorably with any other method and surpasses them in ease of acquiring a safe technic.

GJESSING (236, **A case of electric cataract**) reports the case of a 12-year-old boy who received a shock of 50,000 volts, producing burns of the third degree. The condition of the eyes at first was normal, but vision was noticed to be impaired six months later. After another six months both eyes presented the typical picture of electric cataract, the left being the more dense. Examination with Gullstrand's slit-lamp showed a confused network of corkscrew-like threads which in no way followed the course of the lenticular fibers. Between them were glistening points and, close under the capsule were delicate, bleb-like formations. The vision of the right eye was $\frac{5}{15}$, that of the left fingers at two meters.

KRAUPA (238, **Ruptures of the lens capsule without traumatic cataract**) observed the following in a 60-year-old patient who had received a blow on his left eye ..ve years before. In

the middle of the pupil on the lens capsule was a flickering, transparent, pentagonal bit of membrane joined above to the capsule. The other margins were rolled in. With the slit-lamp a rupture of the capsule measuring 2 by 3 *mm* could be made out. The lens was clear.

LINDBERG (241, **Does the iris play a part in the spread of naphthalin cataract?**) observed that a naphthalin cataract developed more rapidly in one eye of a rabbit, the pupil of which was the smaller, than in the other. He then noticed that the pupillary region in both eyes was free from cataract, but the cataract was more extensive in the eye with the smaller pupil. In eleven cases he made an artificial coloboma in the iris, allowed healing to become perfect and then started feeding naphthalin. In four of these cases the typical naphthalin opacity appeared beneath the iris, or in its immediate vicinity, while the region of the coloboma remained free. So the iris seems to take a part in the extension of this condition.

ROLLET AND BUSSY (247, **Black cataract**) report the case of a man 60 years old who had double black cataract. The right eye had been lost ten years before from panophthalmitis following extraction, the left had good projection. Extraction with iridectomy of a very hard, large, black lens was performed without accident. Postoperative course normal for a week. At the beginning of the second week a severe iridocyclitis suddenly set in, which in spite of all treatment resulted in occlusion of the pupil, hypotony, and doubtful projection. The writers define black cataract as a senile cataract in which the black staining reaches into the cortical layers. It develops slowly in externally healthy eyes and presents as its special characteristic a normally black pupil. Histologically the extracted lens consists of a uniform mass of dense, thickened lens fibers reaching to the capsule in which fatty granules are absent. The presence of iron and tyrosin could be demonstrated chemically. The latter is present in the form of an oxide and causes the typical diffuse staining.

SEEFELDER (248, **Origin of congenital cataract**) gives the results of his microscopical examination of the eyes of a child 4 months old with congenital cataract who died from bronchitis. No family history of eye trouble was obtained. The

same condition had been present in both eyes, but the right had been needled. The left lens seemed rather large but was perhaps about normal in size. Approximately normal lens fibers were found only in the immediate neighborhood of the equator, but even these were infiltrated by empty hollow spaces. By far the greatest part of the contents of the lens capsule consisted of a formless, crumbly, or homogeneous mass in which were some traces of broken up lens fibers. The capsular epithelium was normal, the anterior capsule uninjured. Yet in the next sentence is described a gaping fissure in the capsule, medially, inward and downward, through which lens masses protruded and surrounded by cell proliferation. The remaining sections of the eye showed no perceptible changes. Seefelder (thinks the rupture of the capsule was secondary to the formation of the cataract and not primary; that the increase of the contents of the capsule caused the capsule to burst, and that the cause of the lenticular change was toxic. This being so, congenital cataract is not a true malformation.

THOMSON (249, **Capsular cataract associated with a deposit of pigment at or around the center of the capsule**) found seven cases of this nature among a total of 7500 school children. The children were not related. In four the condition was present in both eyes. In and about the center of the lens and in a portion of the periphery capsular or subcapsular deposits of pigment were found. In six cases bluish radiating lenticular opacities were added, adhesions of the iris were present in two, remains of a pupillary membrane in one. The author believes the condition to be due to a disturbance of development.

ZENTMAYER (252, **Pathogenesis of Vossius ring cataract**) accidentally produced the condition which Hesse endeavored to produce artificially. The case proves that the Vossius ring can result from the deposition of blood on the anterior capsule. ALLING.

FRESE (233, **Slit-lamp picture of electric cataract**) distinguishes two groups of cases, one characterized by dense, radiating subepithelial opacities clearly following the course of the fibers, the other by the addition of many round or oval bleb or drop-like formations close beneath the capsule which

are not opaque, but may appear so in consequence of irregular reflection, and cause slight protrusions of the capsule.

The case described by GIFFORD and LATTA (235, **Pseudoglioma and remains of the tunica vasculosa lentis**) was a child three months old showing a yellow reflex in the pupil which was noticed sometime after birth. It covered the whole of the posterior surface of the lens so that a faint reflex could be seen. The eye was slightly smaller than the other and the tension was not raised. The eye was enucleated. Sections showed the entire posterior surface to be covered by dense white fibrous connective tissue. The ciliary processes were very hazy and fused with the fibrous mass. Two other cases were examples of congenital fibrous tissue formation on the posterior surface of the lens with persistent hyaloid artery. ALLING.

MEESMANN (243, **Behavior of the zonule in luxation of the lens**) found with the slit-lamp no trace of the fibers of the zonule at the equator of the lens in complete displacement. Similar observations were made in cases of cataract removed in capsule by Barraquer's method and in a spontaneous extrusion of the lens after an iridectomy for glaucoma. In these the remains of the zonule were absent usually only in places, but were completely absent in the case of spontaneous extrusion. In a traumatic subluxation there was also no trace of the zonule, the lenticular capsule was not demonstrably changed. The sagittal ridges at the equator of the lens were particularly distinct. In the upper edge of the maximally dilated pupil at the level of the equator of the lens could be seen a gray white, distinctly radiating and concentric bandlike structure running parallel to the margin of the lens; this consisted of the zonular lamella of the lens capsule, which here was totally detached. This gives rise to the suggestion that the zonular lamella does not spring embryologically from the lens capsule, but from the zonule fibers themselves.

MEESMANN (244, **The picture of subluxation and ectopia of the lens with the slit-lamp**), thus summarizes the results of his studies. 1. The changes in the fibers of the zonule made visible with the slit-lamp in ectopia and spontaneous luxation of the lens consist of a thickening, opacity and

diminution of firmness (hyaline degeneration?) and consequently of a stretching of the individual fibers throughout their entire visible course. No essential thinning and atrophy was found, rather swelling and opacity. 2. In traumatic subluxation several degrees must be distinguished; (a) slight prolapse of vitreous into the anterior chamber without demonstrable displacement of the lens. Such a prolapse without laceration of the fibers of the zonule is unthinkable. (b) Partial stretching of the fibers of the zonule without prolapse of vitreous. The edge of the lens can be seen only when the pupil is maximally dilated. The zonule fibers suffer degenerative changes similar to those mentioned above. (c) larger subluxations with prolapse of vitreous. Short torn ends of fibers may be found on the edge of the lens, but may be completely absent. The latter is explained by a total detachment of the zonular lamella from the lens capsule. 3. The suggestion is advanced again that the zonular lamella does not belong embryologically to the lens capsule, but is developed from the fibers of the zonule.

ROCHE (246, **Bilateral luxation of the lens into the anterior chamber**) reports a case of spontaneous luxation of this nature in a 5-year-old girl. Useful vision was given the right eye by operation but the left was neglected and lost through glaucoma and uveitis. No stigmata of syphilis, but the iris showed a distinctly atrophic zone, which suggested the possibility of an interuterine uveitis. Perhaps it was a case of bilateral ectopia lentis.

BEDELL (227, **Study of the vitreous**) gives a clear conception of the value of the microscope with the diaphragm illumination in demonstrating the vitreous structure. He describes with illustrations, the presence of pigmentation, uveitis with its pathological changes, prolapse of the vitreous and the changes in the vitreous that accompanies lenticular disturbances. ALLING.

PETER (245, **Slit-lamp studies of hernia of the vitreous**) has examined a number of cases of prolapse of the vitreous into the anterior chamber through the pupil after cataract extraction or after spontaneous absorption. Some of these cases were operated upon by the Barraquer and by the Smith method. Further study of these conditions may throw light

on the glaucoma and other implications following extractions and discissions. ALLING.

BRAUN (228, **Results with replacement of the vitreous**) gives the following as the results in sixty-one cases in which Elschnig's operation of injection to replace lost vitreous was employed. Good results were obtained after fresh injuries and loss of vitreous in cataract operations. Five infected eyes gave one material improvement, two only transient betterment. Twenty-three cases of traumatic hemorrhage into the vitreous were treated, eleven with perforating wounds; two eyes were unchanged, one had transient betterment, four were slightly improved, four were made worse. In hemorrhages without opening of the eyeball five were made worse, one improved. In four hemorrhages after operation two were improved, two made worse. Little result was obtained in six cases of cyclitic opacities. Twenty-six operations were performed on twenty-one eyes with spontaneous hemorrhages, in three of which the injected fluid was repeatedly sucked out and new fluid injected; this procedure was usually not irritating to the eye, but in four there was slight, in four severe irritation caused, two with hypopyon and two with iritis. Six improvements were obtained in eleven eyes with juvenile hemorrhages into the vitreous, three were made worse. Five improvements in eleven eyes with hemorrhages in old people, four were made worse.

KRESS (239, **Cysticercus of the vitreous with case report**) describes a case in which a cysticercus was found in the vitreous of a patient who harbored a tape worm. After the lapse of a year the eye became inflamed, hard and painful so that it was enucleated. ALLING.

(*To be continued.*)

NOTICES.

Société Française d'Ophtalmologie.

The next Congress of the Société Française d'Ophtalmologie will be in Paris during the second week in May. The first session will be held on Monday, May the 10th.

A report upon "The Microscopic Examination of Affections of the Eye by Means of the Slit-Lamp" will be presented by Professor Gallemaerts of Brussels.

Those desiring information concerning the Congress should write to Doctor René Onfray, 6 av. de la Motte-Picquet, Paris 7e.

Professor Felix Lagrange.

On the occasion of the election of Professor Felix Lagrange to the Institute, as correspondent of the Academy of Sciences, a Committee has been formed to collect in one volume, the principal original papers written by Professor Lagrange, as head of the Ophthalmological School of Bordeaux and under his direction.

This volume is to be named *Felix Lagrange and His Pupils*.

The Committee consists of Professor Aubaret, Dr. Beauvieux, Dr. Calamet, Dr. Cosse, Dr. Delorme, Dr. Ginestous, Dr. Lacroix, Professor Lacoste, Dr. Max Monod, Professor Muratet, Dr. Paul Pesme, Professor Teulières, and Gaston Doin & Company, editors.

The subscription to this scientific volume is fixed at 100 fr. It can be ordered from Gaston Doin & Co., 8 Place de l'Odéon, Paris, or Professor Teulières, 19 Cours de Verdun, Bordeaux.

Oxford Ophthalmological Congress.

Master, Philip H. Adams.
Hon. Treasurer, Robert J. Coulter.
Hon. Secretary, Bernard Cridland, Salisbury House, Wolverhampton.
Founder, Robert W. Doyne.

PRELIMINARY NOTICE.

The Oxford Ophthalmological Congress will assemble at Keble College on the evening of Wednesday, July 14th, next, and the Meeting will be held on Thursday, July 15th, Friday, July 16th, and Saturday, July 17th.

On the morning of Thursday, July 15th, a discussion will be held on "Sympathetic Ophthalmia" to be opened by Malcolm L. Hepburn, Esq., followed by S. H. Browning, Esq., and Dr. T. Harrison Butler.

Members intending to take part in the Discussion are requested to kindly send in their names to the Hon. Secretary at their early convenience.

The Doyne Memorial Lecture will be delivered on the morning of Friday, July 16th, by Thomson Henderson, Esq., M.D., Ch.B., the subject being "The Anatomy and Physiology of Accommodation in Mammalia."

It is proposed at this Meeting to devote one afternoon entirely to demonstrations in the Scientific and Commercial Museums and it is hoped that members will do their best to bring forward novelties of any kind, *e.g.*, pathological specimens, operations, apparatus, etc.

It will be appreciated if those who desire to contribute either papers or demonstrations will kindly notify the Hon. Secretary at their early convenience.

The Official Dinner of the Congress will take place on the evening of Thursday, July 15th, in the Hall of Keble College.

A General Meeting will be held during the Congress at a time of which due notice will be given in the final programme.

Bernard Cridland,
Hon. Secretary.

Salisbury House,
Wolverhampton.

Announcement of the Third Postgraduate Course in Ophthalmology, Autumn, 1926.

The third special course for postgraduate study in ophthalmology will be given between Oct. 1st and Dec. 4th, 1926, at the I. and II. Eye clinics of the Allgemeines Krankenhaus, Vienna, Austria.

This intensive postgraduate instruction was first originated in Vienna in 1922 as a result of a suggestion by Dr. Edward Jackson of Denver to Prof. E. Fuchs. Prof. E. Fuchs is kind enough to participate in the program. Prof. Dimmer and Prof. Meller, chiefs of the two eye clinics, have again consented to take an active part. The other lectures will be given by Prof. Lindner, Docent A. Fuchs and Docent Bachstez, and the Assistants Dr. Guist, Dr. Pillat, Dr. Safar, Dr. Urbanek and Dr. Sallmann. Professors, Docents and Assistants of other departments will deliver lectures in their respective subjects: Prof. Kreidl on Physiology of the eye, Prof. Schüller on X-rays, Docent Hirsch on the Hypophysis, Assistant Sternberg on Embryology, Docent Luger on Herpes and Arteriosclerosis, Docent Elias on Diabetes, Docent Kollert on Kidney-diseases, Docent Kofler on the modified West-operation, Assistant Kummer on Radium-treatment.

The course has been so arranged that the field can be covered systematically and comprehensively in the allotted time. A preliminary knowledge of ophthalmology is presupposed.

Concerning operations, use of slit-lamp, and skiascopy with cylinders, only lectures with demonstrations will be given. There will be an opportunity, however, for small groups of men to do practical work in these fields in both Eye clinics at the current fees. In ophthalmoscopy the non-electric ophthalmoscope will be used.

The entire course will be given in English and for a minimum of ten, and a maximum of fifteen men. The fee is $235 a man. Applications with a certified bank check to the amount of $50 enclosed should be sent to Docent A. Fuchs, Vienna, VIII. Skodagasse 13. Applications are accepted in order of priority.

Further information can be secured by writing to Doc. Dr. A. Fuchs, Vienna, VIII. Skodagasse 13.

BOOK REVIEWS.

I.—**Slit-Lamp Microscopy of the Living Eye, Early Diagnosis and Symptomatology of Affections of the Anterior Segment of the eye.** By Dr. F. Ed. Koby. Translated by Charles Goulden, O.B.E., F.R.C.S., Surgeon to the Royal London Ophthalmic (Moorfields) Hospital, and Clara Lomas Harris, M.B., Chief Clinical Assistant, Royal London Ophthalmic (Moorfields) Hospital. P. Blakiston's Son & Co., 1925, Philadelphia. Price $3.50.

The author in his introduction says, "It may appear bold to condense at this moment, the knowledge acquired, the more so as on certain subjects irreconcilable opinions have been expressed," but this excellent little volume needs no apology as it is the type of book needed for the practical study of the slit lamp microscopy of the living eye, particularly for beginners in the use of the Slit-Lamp-Corneal-Microscope. The translators have well said, "There are few textbooks on the subject in any language, and in none has the author set out so clearly the methods of use and fields of application of the slit-lamp." The arrangement of the subject matter is well ordered and logical.

In the first chapter the microscope and lamp are described along with the adjustment of the apparatus, and the optical principles and their application to the clinical examinations are discussed. The more extensive description of apparatus is evidently that of the Zeiss instrument while a paragraph is given to a description of the Bausch and Lomb model of which the author says, "We have had no experience with this apparatus and reserve our judgment."

There are so many angles and complicated details in the use and application of this aid to ophthalmic examinations that no description, however minute, can replace individual

and personal instruction in mastering its use, and terms, many coined, many borrowed from physics but newly applied in ophthalmology, need personal explanation and definition.

In chapter two the description of the methods of examination follow closely but amplify those described in Vogt's Atlas. The use of the catoptric image, an original method for localization of depth, is introduced as are the use of the reflex of the posterior capsule and scleral scatter as described by Graves. In this chapter a detailed but brief description of the general technique of examination is given and valuable suggestions for practical exercises for the beginner are made. The use of animal eyes for practice is advised. They are very satisfactory for early study.

Chapter three considers the phenomena of reflection of light by the ocular media and the term zones of discontinuity, used by physicists to indicate optical surfaces where the index of refraction suddenly changes, is used to describe such zones in the lens. The use of the term specular reflection to denote mirror-like reflection is more accurately descriptive than that of reflection zone used in Von Der Heydt's translation of Vogt's Atlas.

There is a discussion of the phenomena of light reflection as follows—from the anterior and posterior surfaces and interior of the cornea, the structureless membranes, anterior and posterior surfaces and interior of the lens.

In chapter four the conjunctiva is briefly considered. The use of the author's method of the astigmatic beam for the study of the conjunctiva is advocated and the use of the red-free light in the study of the conjunctival vessels is not as "the red-free filter absorbs so much light that its advantage is not apparent." Special technique for examining the cornea, the appearance of the normal cornea, congenital anomalies, senile modifications, traumatic lesions, and pathological changes in the cornea, are described in considerable detail in chapter five.

The author says "the method of examination in zones of specular reflection finds its greatest application in the cornea" but he does not describe with sufficient clearness the method of getting the various structures in the axis of specular reflection which is probably the most difficult procedure in slit-lamp

microscopy. He does not agree with Koeppe in that it is "possible to distinguish the opacities of the lamellar system from those of the lacunar system in the corneal stroma." He says "as in certain conditions, it may be difficult to differentiate between a nerve trunk and a vessel, two methods of examination will always be employed," but he does not say what the methods or distinguishing features are and it is the same with folds and tears in Descemet's membrane. He discusses very ably pathological changes in the epithelium, stroma and Descemet's membrane and precipitates on the post-corneal surface. In this chapter there is a good summary of most that has been written upon the microscopy of the living cornea.

In chapter four the special technique for examining the anterior chamber, deposits of cellular elements on the post-corneal surface, congenital anomalies, senile modifications, traumatic lesions and pathological changes in the anterior chamber are described. The meager description of the special technique for examining the anterior chamber is certainly not sufficient in detail to enable one not already conversant with it to see the floating elements and the path of the beam in the aqueous, one of the most difficult things in slit-lamp microscopy to learn.

The special technique for examining the iris, the normal iris, congenital anomalies, senile modifications, traumatic lesions pathological changes in the iris are taken up in chapter seven. A good description of the appearance of the normal iris is given. The author is not in agreement with Koeppe that "depigmentation of the iris was the expression of a glaucomatous state (pre-glaucoma)." However it will be interesting for observers to make care ul notes over long periods in cases showing deposits of pigment granules in the iris stroma and on the post surface of the cornea with a view of determining whether or not these changes are forerunners of glaucoma. There has been considerable discussion amongst observers as to whether or not posterior synechiæ are formed in the condition in which nodular exudates form at the pupillary margin. This condition is shown as "tubercles of the iris" in a drawing in Vogt's Atlas. Speaking of these nodules Koby says: "The nodules at the pupillary border are generally

too small to produce synechiæ, but if several nodules are situated close together a synechia may be formed. These nodules are produced by condensations of exudate and of cellular deposits usually without tissue formation. They are seen especially in tuberculous affections, but may occur in other conditions."

Chapter eight, the longest and probably the most interesting in the volume, is given over to a study of the crystalline lens. The special technique for examining the lens, the zones of discontinuity, the sutures, the fœtal nucleus, the adult nucleus (a better term than Vogt's senile nucleus), the cortex and the shagreen of the normal lens are described. Congenital anomalies associated with the lens as remains of pupillary membrane and hyaloid artery are considered in conjunction with the lens. The star-like remains so commonly seen upon the anterior capsule of the lens, 35 to 40% of cases, have been proven by Arlt to be, histologically, each star a cell with a nucleus and numerous pseudopodia. The following congenital anomalies are described: posterior lenticonus, opacity of the sutures, anterior capsular cataract, anterior polar cataract, zonular cataract, cataract of Mongolian idiocy, and a rare cataract first described by the author and illustrated by a drawing to which he has given the name of floriform cataract. "One class of zonular cataract is congenital; the others are developed at the beginning of extra-uterine life."

Under senile modifications good descriptions are given of sclerosis of the lens, the formation of the relief of the adult nucleus, water splitting and lamellar separation, the two latter being phenomena "intimately connected with cataract." Presenile and senile opacities of the lens are classified, depending upon the layers affected, as: coronary cataract, delacerated cataract, peripheral cuneiform cataract, dustlike cataract in concentric layers, posterior saucer-shaped cataract, nuclear cataract. As the cataract matures these forms are changed by the processes of water splitting lamellar separation, formation of vacuoles and myelin droplets into the familiar picture of mature senile cataract.

Under traumatic lesions subluxation and dislocation of the lens, rupture of the zonular layers, electric cataract, the cataract of siderosis, cataract due to the presence of copper

and traumatic cataract are considered. Two types of traumatic cataract are described: first, the indirect form, in which no change in the capsule is revealed by the slit-lamp, which takes the form of a rosette occupying the axial subcapsular layers and which is susceptible of complete retrogression. Second, the common type of traumatic cataract with opening of the capsule. Under pathological changes the most important is complicated cataract, of which an excellent description is given.

The vitreous body is discussed in chapter nine, the last. Not a great deal is certainly known about the vitreous. The author seems to be in doubt about the existence of an anterior limiting membrane of the vitreous for he says, 'Even with the naked eye one sees, limiting the retro-lental space posteriorly, a more or less vertical reflex which marks the anterior *limiting layer* of the framework of the vitreous. No true structureless membrane exists in this situation, but in certain cases, especially in hernias of the vitreous in an aphakic eye, the luminous reflex is so clear at the surface that one is tempted to admit, wrongly perhaps, a superficial condensation of the fibrils, or a difference between the indices of refraction of the vitreous with its connective tissue and the aqueous humor." Hernias of the vitreous into the anterior chamber after needlings of secondary cataract are so frequent that this is the rule, the author believes.

Under the two general headings (a) more or less complete destruction of the regular fibrous framework and (b) the appearance of opacities, which are precipitated in the fibers, or seem to float in the spaces, the pathological changes of the vitreous are discussed.

Forty-three illustrations and a very good bibliography add to the value of the book. The print is large, clear and easy to read. While not a complete textbook the volume is more than a compend and assuredly "fills a gap" in the literature on this subject.

T. H. JOHNSON.

II.—**Helmholtz's Treatise on Physiological Optics.** Translated from the 3d German edition. Edited by James P. C. Southall, Professor of Physics, Columbia University.

Volume II. **The Sensations of Vision,** pp. 499. Published by the Optical Society of America, 1924. Price, $7.

The second volume on the Sensations of Vision treats of Stimulations of the Organ of Vision, Stimulation by Light, Changes in the Retina Due to Light (W. Nagel), the Simple Colors, the Compound Colors; on the Intensity of the Light Sensation, Duration of the Sensation of Light, Variations of Sensitivity, Contrast, and various subjective phenomena. An appendix by W. Nagel is added on Adaptation, Twilight Vision and the Duplicity Theory, followed by an appendix by v. Kries on Normal and Anomalous Color Systems and Theories of Vision. Finally a concluding chapter on the nature of the color sensations is furnished by Christine Ladd-Franklin. There is a partial bibliography, 1911–1924, and corrigenda for volume I.

Volume III.—**The Perceptions of Vision,** pp. 736, 1925, price $7, or $21 for the complete set. To be ordered from the Secretary of the Optical Society of America, Rockefeller Hall, Ithaca, N. Y.

The subject of this volume, The Perceptions of Vision, is studied under the following headings: Concerning the Perceptions in General, Movements of the Eyes, the Monocular Field of Vision, Perception of Depth, Binocular Double Vision, Rivalry between the Visual Globes, with additional notes by v. Kries, to each chapter, and a Review of the Theories. v. Kries has furthermore added:

I. Concerning the Spatial Configurations in Vision, with special reference to the question on Innate Dispositions and Experience; as to the Nature of the Idea of Space in General; concerning the Relations of Normal Localization; on Changes of Localization for Anomalous Adjustments of the Eye; Learning to See and Forgetting; the Physiological Foundations of Judgment and Learning; Empiricism and Nativism; concerning the origin of the Laws of Ocular Movements; Historical and Critical Comments; and

II. On the Theory of Binocular Instruments. A partial bibliography, 1911–1925, corrigenda to volume II, and an Index of Subjects and one of Authors, conclude this volume.

The editor and his colleagues are to be congratulated upon

the completion of this translation of a classical treatise whereby this important work is made accessible to English-speaking ophthalmologists. It touches on so many of the scientific aspects of the Physiology of Vision, that its study is essential for investigators in that particular field and should serve as a stimulus to important investigations. The work of the translators is accurate; the book-making is excellent; the Helmholtz in English should occupy a distinguished place in every ophthalmological library.

A. K.